Draft Environmental Impact Statement For Deschutes National Forest Land and Resource Management Plan

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Draft Environmental Impact Statement

Deschutes National Forest Land and Resource Management Plan

Deschutes, Jefferson, Klamath, and Lake Counties, Oregon

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Abstract:

The Forest Service, in compliance with the National Environmental Policy Act of 1969 and the Forest and Rangeland Renewable Resources Planning Act of 1974—as amended by the National Forest Management Act of 1976—is presenting eight alternatives for management of the Deschutes National Forest's 1.6 million acres. The Forest Service Preferred Alternative, as presented in the Draft Environmental Impact Statement document, is Alternative E. It departs from long run sustained yield to allow the Forest to deal with the mountain pine beetle epidemic and to provide for community stability. It has the fourth highest present net value.

The separate Proposed Forest Plan document outlines the treatment of the issues and concerns; analyzes the current management situation; and sets forth the proposed standards, guidelines, and prescriptions for managing the Deschutes National Forest under Alternative E. Following analysis of public comments, a Final Environmental Impact Statement and Forest Plan will be prepared which will provide direction for management of the Deschutes National Forest for the next 10 to 15 years, unless revised sooner.

The comment period ends May 9, 1986.

Dear Reader,

The Deschutes National Forest's Draft Environmental Impact Statement: Land and Resource Management Resource Plan represents a milestone in National Forest management. The Forest Supervisor and his staff have given Forest Planning high priority in the last five years. They have been committed to completing the Forest Plans so that we can move into a new era of management.

The Draft Environmental Impact Statement identifies a range of alternative plans for managing the Forest. It also describes a preferred alternative that the Forest Service thinks best treats major issues by you and agency employees.

The Response Form with this packet is designed to help you review the planning documents. It may make it easier for you to respond. We must have your comments by May 9, 1986.

This Draft Environmental Impact Statement is subject to some adjustments pending the decision on the Supplemental Environmental Impact Statement for the Regional Guide for the Pacific Northwest Region. The Regional Guide Supplement is being prepared to address spotted owls and could result in some minor adjustments for the Deschutes National Forest.

Your thoughts and concerns are important. I will weigh all public comments carefully. Your comments will help the Forest Supervisor and me to select the best alternative suitable for the Deschutes National Forest.

TOM COSTON
Regional Forester

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SUMMARY

Purpose and Need

The purpose of this Draft Environmental Impact Statement (DEIS) is to describe alternative plans for managing the Deschutes National Forest, including the Preferred Alternative. The DEIS also describes the affected environment and addresses the consequences of implementing the Preferred and other Alternatives considered. A Proposed Forest Plan for any of the Alternatives would be in effect for 10 to 15 years, unless revised sooner.

This document is a general summary of the entire DEIS and emphasizes the issues and concerns raised by the public and other local, state, and federal agencies, including the Forest Service, regarding the management of the Deschutes National Forest. It briefly describes the themes of the Alternatives and how they were developed, the unavoidable adverse impacts, the irreversible/irretrievable effects of implementation, and the major conclusions of the planning process. The tables show management areas and resources, land uses, and outputs and effects for each Alternative.

Affected Environment

The Deschutes National Forest encompasses 1.6 million acres of forested land along the eastern flanks of the Cascade Range in central Oregon. It lies mostly in Deschutes County but extends into Jefferson County on the north and into Klamath and Lake Counties on the south and east. The Forest is a diverse landscape of mountain peaks, lakes and rivers, timbered lands, volcanic formations, and dry desert.

Timber is predominantly ponderosa and lodgepole pine, mountain hemlock, Douglas, white and grand fir. Over 350 species of fish, wildlife and birds, including the bald eagle and northern spotted owl, inhabit the Forest.

The cities of Bend and Redmond are the largest population centers adjacent to the Forest; but Madras, Sisters, Sunriver, LaPine, Gilchrist, and Crescent are smaller communities which also rely on the Forest and its resources. The mainstays of the local economy are timber harvesting and recreation. Over 212 million board feet of timber was harvested in 1984. The region's climate and environmental diversity provide for a variety of summer and winter recreation opportunities, attracting over 2.5 million visitors each year. Recently, the potential of Newberry Crater as a provider of geothermal energy has attracted national interest.

Deschutes National Forest headquarters and two Ranger District offices are located in Bend. Ranger District Offices are also located in Sisters and Crescent. The Redmond Air Center, situated at the Redmond Airport, and the Bend Pine Nursery are administered by the Supervisor's Office in Bend.

Map I shows the location of the Deschutes National Forest.

Alternatives, Including the Proposed Action

National Forest Management Act Planning Process

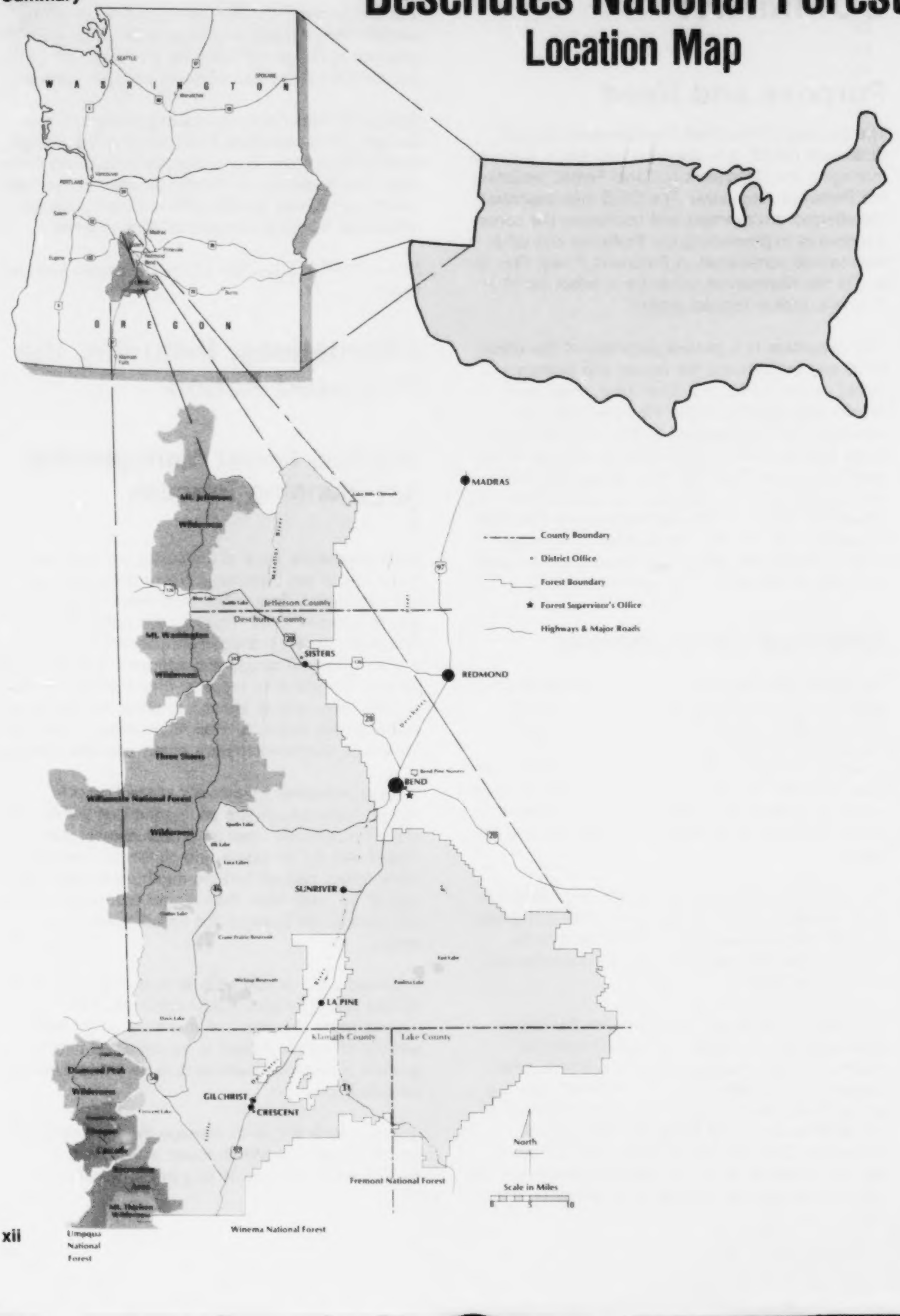
Eight alternative ways of managing the land and resources of the Deschutes National Forest have been analyzed. Each Alternative presents a different way to address local, regional, and national public issues and forest management concerns. Although a wide variety of issues and concerns was identified early in the planning process, only a small number of them were critical enough to affect the proposed management direction in all Alternatives. These major issues and concerns are briefly described below.

A major economic commodity of the Forest is timber. Many people are concerned that the Forest might be primarily used for timber harvest with regard only for monetary and commodity values; while others believe that too much area might be tied up for uses other than timber production, thus diminishing the base for the Forest products industry.

A related issue is how best to treat and manage the current mountain pine beetle epidemic. The management direction that is set will affect the amount of wildlife habitat to be protected and the amount of firewood (fuelwood) to be made available for public use.

Another issue is how to manage the remaining old-growth forest. Old-growth forest is important to many people because of its genetic, wildlife,

Deschutes National Forest
Location Map


SEATTLE
SPOKANE
W A S H I N G T O N
Wenatchee
Vancouver
PORTLAND
Salem
Eugene
Madras
Prineville
Redmond
Bend
Burns
O R E G O N
Klamath Falls
MADRAS
Lake Billy Chinook
Metolius River
Mt. Jefferson
Wilderness
Blue Lake
Suttle Lake
Jefferson County
Deschutes County
Mt. Washington
Wilderness
SISTERS
REDMOND
Deschutes
Three Sisters
Willamette National Forest
Wilderness
Bend Pine Nursery
BEND
Sparks Lake
Elk Lake
Lava Lakes
SUNRIVER
Crane Prairie Reservoir
Wickiup Reservoir
East Lake
Paulina Lake
LA PINE
Davis Lake
Klamath County
Lake County
Diamond Peak
Wilderness
Crescent Lake
Oregon
Cascade
Recreation
Area
Mt. Thielsen
Wilderness
GILCHRIST
CRESCENT
Fremont National Forest
North
Scale in Miles
0
5
10
Winema National Forest
Umpqua
National
Forest
County Boundary
District Office
Forest Boundary
Forest Supervisor's Office
Highways & Major Roads
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economic, scenic, and historical values, all of which affect the amount of old growth that should be harvested.

A different area of concern is how best to manage and protect the wildlife which inhabits the Forest, especially the habitat of threatened, endangered, or sensitive species. This issue is correlated with the extent of timber harvest, recreation, and other Forest developments. Old-growth forest is important habitat for nesting pairs of bald eagles and northern spotted owls, which are classified as Threatened and Sensitive species. Mule deer and elk are other species of concern.

The Deschutes National Forest is one of the most popular summer and winter recreation areas in the entire Region. Recreation use is high and the demand is increasing, especially for dispersed recreational opportunities. An important issue is how much area should be left without developments such as campgrounds or other facilities, beyond what is already available in the Oregon Cascade Recreation area, existing Wilderness, and unroaded areas.

This availability of dispersed recreation areas is related to how the Forest should manage existing roadless areas for a variety of resources and uses. The Oregon Wilderness Bill of 1984 left some 145,000 acres of roadless areas which would release these lands for management such as roads to access and utilize areas for timber harvest, geothermal development, and motorized recreation.

Geothermal development has become another issue of local and regional concern. The Forest already has about 350,000 acres under lease for geothermal development. Other areas of the Forest have geothermal potential; but are not yet leased. How much area should be leased and developed, and under what conditions to protect other resources, are important issues.

Resource Planning Act (RPA) targets are established at the National level for each Region. Whether the Forest is capable of producing these outputs within acceptable environmental and social limits presents another major issue requiring evaluation during Forest Planning.

All of these issues were the common threads throughout the entire planning process. They are issues of widespread public interest and concern relating to the management of the Forest. Other resource and forest use issues, such as maintaining water quality and soil productivity, development of additional recreational facilities, and protection of cultural sites, were not critical to the analysis of the alternatives because they are treated the same through the application of the Forest's Standards and Guidelines.

Existing Condition

The Forest is currently managed under the direction and guidelines established in the 1978 Land Management Plan. Although that 1978 plan provides for a blend of timber harvest, recreation development, and resource management and protection, it does not meet the intent of the National Forest Management Act of 1976 nor does it provide sufficient direction to meet current issues and concerns.

The 1978 plan provides only limited direction for long-term management of the mountain pine beetle epidemic, commercial and personal use firewood programs, Roadless Areas, and bald eagle and spotted owl habitat. It does not address the recent shift in emphasis from visual to recreation management nor does it integrate the direction with existing resource plans. Through an Analysis of the Management Situation, it was determined that some management direction needed to be changed and new directions established.

Alternative Land Management Plans

The National Forest Management Act requires that each Alternative considered is capable of being achieved, addresses major public issues and concerns, and is cost-efficient. It also requires a Current Direction Alternative.

The Alternatives are based on management prescriptions which are strategies for managing particular types of Forest resources. These are called Management Areas. Some emphasize protection of wildlife habitat and naturally occurring ecosystems, while others emphasize sustained timber yields and various types of recreation opportunities. Each Alternative distributes Forest lands to Management Areas in different ways. These are listed by acreage in Table S-1 and on accompanying maps.

TABLE S-1 Acreages in Management Areas By Alternative

Management Areas	(Current Direction) A	(RPA) B	C	D	(Preferred) E	F	G	H
1	39,717	18,805	13,440	18,907	19,243	18,043	15,781	16,298
2 (Research Natural Areas)	7,227	6,565	2,939	3,435	6,976	7,648	7,376	7,376
3	3,520	19,797	15,360	20,144	19,797	19,862	21,131	21,109
4	0	8,085	7,280	15,168	8,085	7,376	14,442	16,459
5	9,600	9,531	0	20,997	9,531	9,403	31,317	30,912
6 (Wilderness)	182,506	182,506	182,506	182,506	182,506	182,506	182,506	182,506
7	195,535	192,127	229,337	183,674	212,063	202,895	118,591	94,138
8	657,107	721,291	937,286	702,164	717,219	710,812	779,056	845,722
9	338,223	226,452	43,445	269,305	212,355	233,049	141,856	108,273
10 (Bend M. Watershed)	3,536	3,536	3,536	3,536	3,536	3,536	3,536	3,536
11	8,911	71,821	105,108	98,784	79,648	74,586	57,444	62,106
12	57,361	61,941	1,408	18,192	44,762	62,794	145,450	121,349
13	0	26,309	26,069	19,675	32,640	10,235	0	4,933
14 (Oregon Cascade Recreation Area)	42,656	42,656	42,656	42,656	42,656	42,656	42,656	42,656
15	29,106	18,948	0	11,227	19,353	24,969	49,228	52,997
16 (Experimental Forest)	10,042	10,042	10,042	10,042	10,042	10,042	10,042	10,042
Protection Management[1]	31,861							
Mining Claims[1]	3,504							
TOTAL	1,620,412	1,620,412	1,620,412	1,620,412	1,620,412	1,620,412	1,620,412	1,620,412

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[1] Management options included in the 1978 Land Management Plan but which were not used as general strategies in developing the Alternatives.

Each Alternative is comprised of land uses, management practices, and activity schedules which result in a unique combination of resource outputs, land uses, and environmental conditions.

The Alternatives were compared against "benchmarks" which are a combination of land capability, management practices, and schedules to achieve certain objectives. But, because they lack a consideration of budget, geographic, legal, resource, and other constraints and requirements, they usually could not be implemented. They do provide significant information about maximum biological and economic production opportunities.

Selection of a Preferred Alternative is based on comparisons of public issues, resource outputs, environmental effects, implementation costs, and "trade-offs" among Alternatives. The Preferred Alternative is selected by the Regional Forester.

Alternative A - Current Direction

The Current Direction Alternative represents the existing management direction required under the National Environmental Policy Act and features a blend of land uses intended to balance resource uses. Timber, dispersed recreation, visual quality, and deer habitat management are emphasized.

Less emphasis is placed on developed recreation, old growth, and threatened and endangered species. This Alternative does not address geothermal leasing nor the long-term demand for personal use firewood in areas affected by the mountain pine beetle epidemic.

Alternative B - Resources Planning Act

Alternative B meets the goals and targets established for the Deschutes National Forest under the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA). Timber harvest would accelerate to meet RPA targets. An annual limit could be set on the amount of personal use firewood to meet long-term demand. Developed and dispersed recreation would be equally developed to meet long-term demands. Some higher potential geothermal areas would be available for leasing.

Deer and bald eagle habitat would be increased. Scenic quality would be emphasized along heavily traveled roads, developed recreation areas, and roads to trailheads. The Forest would be intensively used and developed, but options for preserving undeveloped lands and old-growth ecosytems would be retained.

Alternative C

This Alternative emphasizes the commodities and resources which have potential to increase contributions to the local and regional economy. A significant part of the Forest would be intensively managed for timber production. The price of firewood could increase significantly, because it would compete with other wood markets without special provisions for personal use.

Recreation would focus on providing access and facilities for large numbers of people. Much of the Forest would be available for motorized recreation. The Forest would be heavily roaded. Geothermal leasing would be permitted in Newberry Crater.

Deer habitat would be increased. Scenic quality would be protected along heavily traveled roads. Old-growth forests would not be protected except on lands not scheduled for timber harvest.

Alternative D

This Alternative blends timber production with dispersed recreation opportunities and visual resource management. Much of the Forest would be managed for commercial timber and sale of personal use firewood would be competitive with other wood markets. Day-use recreation would be emphasized and developed at the expense of overnight recreation facilities. Much of the Forest with geothermal potential would be leased.

To complement the recreational emphasis, scenery along travel routes and areas viewed by large concentrations of people would be maintained or enhanced. Areas affected by timber production would be screened from view along major roads and trails. A large amount of habitat for osprey, bald eagles, and deer would be provided. Small areas of old-growth forest would be protected.

Alternative E - Preferred Alternative

This Alternative is similar to Alternative B but the management prescriptions for some areas of the Forest are different. The accompanying maps show these differences. A significant part of the Forest would be intensively managed for timber production. Part of this timber base would be set aside annually for personal use firewood and could be adjusted based on long-term availability and demand.

Both developed and dispersed recreation would be emphasized, though construction of new facilities would be less than in Alternative C. Some land would be managed to provide opportunities for motorized and nonmotorized recreation. Geothermal leasing would be permitted in the Newberry Crater and in other high potential areas.

This Alternative increases habitat for threatened and endangered wildlife. Scenic quality would be protected along heavily used roads, developed recreation areas, and some roads to trailheads. Small areas of old-growth forest are also protected.

Alternative F

Alternatives E and F have similar land use patterns and differ primarily in the management prescriptions applied to various areas of the Forest. The accompanying maps indicate the way this Alternative varies from the others.

Alternative G

This Alternative emphasizes preservation of the ecosystems. Areas available for timber harvest would be reduced. Personal use firewood would be made available and would be adjusted to meet demand. Significant areas of roadless land would remain unroaded and undeveloped. Geothermal leasing would be permitted in only a few areas of Newberry Crater and other high potential areas.

A wide range of recreation opportunities would be provided but emphasis would be on activities not requiring large or extensive developed sites. New construction would be associated with dispersed and unroaded recreation. Motorized recreation would be de-emphasized.

Threatened and endangered plant and animal species and habitat would be maintained at high levels. Deer habitat would decrease because forage and cover are not emphasized in this Alternative. Scenic quality would be maintained along major roads, trails, recreation areas, and undeveloped landscapes. Large areas of old-growth forest would be protected.

Alternative H

This Alternative is a blend of intensive forest management and protection of undeveloped natural ecosystems. It maintains high levels of commodity production in lands that are currently developed, but retains a significant part of roadless land in an undeveloped condition. It is similar to Alternative G but does not sacrifice economic growth. The difference is that a departure timber schedule is used in this Alternative.

Tradeoffs and Comparisons Between Alternatives

The following paragraphs summarize the tradeoffs between the Alternatives as displayed in Table S-2. The focus is on the incremental changes in present net value (PNV) from one Alternative to another as influenced by the production of both priced and nonpriced outputs; and more importantly, the ability of the Alternatives to address the issues and concerns. The Alternatives are discussed in order of decreasing PNV.

Alternative C

Of all the Alternatives, Alternative C has the highest PNV ($1285.8 million). It emphasizes intensive management and the production of market commodities. Accordingly, harvest scheduling is based on departure from nondeclining yield. It also calls for an aggressive accelerated harvesting of mature lodgepole pine stands in reaction to the mountain pine beetle epidemic. The resulting increase in lodgepole pine volume is in addition to maintaining near historic levels of ponderosa pine and mixed conifer volumes. Consequently, it has the highest first decade harvest of any Alternative.

Alternative C exceeds all of the range, recreation, timber, and wildlife RPA targets. In doing so, it generates the largest amount of first decade revenues to both federal and local governments of any of the Alternatives. However, this is not without a cost. Alternative C requires the highest budget of all the Alternatives (32 percent more than current funding levels).

Alternative C assigns the most acreage of any alternative to the provision of developed recreation opportunities. However, it provides the fewest opportunities to meet future needs for dispersed roaded and unroaded recreation.

Alternative C is the most favorable Alternative from a geothermal leasing and development standpoint. While this is not reflected in the present net value of the Alternative, this could result in a real economic plus to the local economy sometime in the next 10 to 20 years.

Of all the Alternatives, Alternative C provides the most opportunity for the mule deer population to increase. In the future this could be translated into more hunting days and, therefore, more hunter expenditures in the local economy.

Table S-2 Quantitative Indicators of Responsiveness to Issues, Concerns, and Opportunities

	Response to Issues, Concerns, and Opportunities								
	Meets or Exceeds RPA Targets								
Alts. Ranked by Decreasing PNV	PNV ($MM)	Dev. Rec. Target (2,050 MRVD)	Disp. Rec. Target (1,930) MRVD)	Range Target (32 MAUM)	Timber Target (41.9 MMCF)	Timber Target (195 MMBF)	Habitat Improvement Target (6.4 M Acre Equiv.)	Avg. Annual 1st Decade Revenues To Govt. ($MM)	Avg. Annual 1st Decade Budget ($MM)
C	1285.8	3,493	2,686	45	59.8	265	30.0	36.3	23.5
F	1125.2	2,638	2,418	29	39.2	174	30.2	25.9	19.1
B	1124.1	2,567	2,386	32	42.0	176	6.4	22.5	20.4
E	1123.4	2,770	2,493	32	46.6	202	27.0	27.1	20.6
D	1121.3	2,983	2,551	29	41.3	171	23.5	21.5	20.1
H	1027.2	2,310	2,220	32	41.7	187	12.5	27.4	20.4
A	741.3	1,837	2,036	29	39.6	190	6.2	30.0	17.8
G	661.3	2,045	2,255	26	32.5	153	16.0	24.8	16.1

		Response to Issues, Concerns, and Opportunities							
Alts.	PNV ($MM)	Decade 1 Firewood Reserved For Personal Use (M Cords)	Dev. Rec. (M Acres)	Undev. Rec. (M Acres)	Visual Quality (M Acres)	OR Dept. F&W Mule Deer Pop. Objectives (24,850 Deer)	Acres Potential Geothermal Avail. For Leasing (M Acres)	Average First Decade Payments to Counties ($MM)	Impact on # of Jobs in Local Economy in 1st Decade (# Changed)
C	1285.8	0	105.1	1.4	207.4	32,300	126.1	8.7	+550
F	1125.2	60	74.6	62.8	360.1	27,100	80.3	6.0	-202
B	1124.1	60	71.8	61.9	365.0	28,600	91.5	5.5	-258
E	1123.4	60	79.6	94.8	344.6	25,900	100.0	6.8	-21
D	1121.3	0	98.8	18.2	358.6	29,800	105.0	5.2	-295
H	1027.2	75	62.1	121.3	411.9	13,300	62.8	6.6	-84
A	741.3	60	8.9	57.4	401.8	20,300	85.9	7.2	0
G	661.3	75	57.4	133.7	426.0	16,700	52.8	6.0	-321

Alternative C is the strongest Alternative in terms of providing the necessary timber and recreation outputs to support the local employment base and to provide opportunity for growth in the future, should the demand for forest-based resources continue to increase. On the other hand, such nonpriced benefits as visual quality, recreation diversity, and easy access to personal use firewood will be at lower standards than today.

Despite its strong economic performance, Alternative C may lead to some conflicts and polarization amongst local communities and other users of the Forest due to its strong orientation toward commodity development.

Alternative F

At $1125.2 million, Alternative F has the second highest PNV of all the Alternatives. This represents a 12.5 percent drop from Alternative C. In contrast to Alternative C, Alternative F proposes to harvest timber on a nondeclining yield basis. Consequently, it has a significantly lower first decade harvest level than Alternative C. While some of this is due to harvesting based upon nondeclining flow as opposed to Alternative C's departure, another component of the tradeoff is Alternative F's emphasis on the visual resource in sensitive scenic areas. Alternative F also places more emphasis on unroaded nonwilderness recreation and less on developed recreation than does Alternative C. This is reflected in its lower discounted recreation benefits.

Despite its relatively strong performance with regard to economic efficiency, Alternative F falls short of both its range and timber RPA targets. It ranks fourth in terms of cash returns to the government (down 16 percent from current revenues), and has the fifth highest budget requirements (up 7 percent from current funding levels).

While Alternative F provides fewer developed recreation opportunities than Alternative C it does offer a more diverse recreation opportunity spectrum through its increased emphasis of dispersed recreation.

Alternative F is considered restrictive concerning the amount of high potential geothermal acres it opens up for leasing (80.3 M Acres as compared to 126.1 M Acres in Alternative C).

Alternative F may result in some slight downward pressure on employment opportunities, primarily due to its substitution of lodgepole pine for the more labor intensive mixed conifer species. On the other hand, it sets aside 60,000 cords of personal use firewood per year, which is a plus with regard to maintaining that aspect of the Central Oregon lifestyle. Visual quality benefits are much higher than Alternative C and only a little lower than the Current Direction (Alternative A). Finally, it exceeds the Department of Fish and Wildlife population targets for deer.

It is anticipated that Alternative F would not cause any significant conflicts or polarization within local communities and other users of the Forest if it were selected as the Preferred Alternative.

Alternative B

The PNV for Alternative B is $1121.3 million, only $1.1 million less than Alternative F. In terms of the emphasis of priced versus nonpriced outputs, Alternatives F and B are similar. However, Alternative B meets or exceeds all of the RPA targets. In order to meet the timber targets, its harvest schedule departs from nondeclining flow. In doing so, it returns 5.5 million dollars to local county governments (seventh highest), and incurs the third highest budget.

While its recreation diversity is similar to Alternative F, Alternative B is more flexible with regard to geothermal leasing. However, its proposed leasing within the Newberry Crater may cause some polarization.

In terms of nonpriced benefits, Alternative B meets or exceeds those provided by Alternative F with regard to personal use firewood and visual quality. Because Alternative B converts 208,000 acres of lodgepole over 15 years, the substitution of the resulting volume for the more labor intensive ponderosa and mixed conifer tree species may cause more downward pressure on the employment base in the local economy than does Alternative F.

Alternative E (Preferred)

At $1123.4 million, Alternative E has the fourth highest PNV, only $.7 million less than Alternative B. Alternative E harvests timber on a departure from nondeclining yield basis and has the second highest first decade average annual harvest level of all the Alternatives.

Due to its departure harvest schedule, Alternative E meets or exceeds all of the RPA targets. In doing so, it generates the third highest revenues to both federal and local governments. However, it also requires the second highest budget (16 percent higher than current funding levels).

Alternative E, like Alternatives B and F, offers a diverse spectrum of recreation opportunities. It is somewhat stronger in its attempt to provide for unroaded nonwilderness experiences which are becoming one of the limited opportunities on this Forest.

It is the third highest in the amount of acres it permits for geothermal leasing, behind Alternatives C and D.

With regard to nonpriced benefits, Alternative E would maintain the firewood burning aspect of the Central Oregon lifestyle by setting aside 60,000 cords of personal use firewood per year during the first decade. Compared to Alternative B, Alternative E offers slightly fewer benefits pertaining to visual quality. However, it exceeds both the State's output levels for projected mule deer populations. Finally, due to its relatively high first decade timber sale levels, Alternative E provides the resource base needed to maintain the Central Oregon economy.

Alternative D

Alternative D has the fifth highest PNV of all the alternatives. At $1121.3 million it is only $2.1 million lower than the PNV of Alternative E. Alternative D schedules timber harvesting on an even flow basis as opposed to Alternative E's departure from nondeclining yield. In fact, the primary reason Alternative E has a higher PNV is because its departure to meet RPA timber targets allowed it to generate $11 million more in discounted timber benefits than Alternative D.

While Alternative D meets or exceeds the recreation and wildlife RPA targets, it falls short with regard to timber and range. Consequently, it ranks seventh in terms of its returns to government (down 40 percent from current returns to government). It ranks fifth in budgetary needs, requiring a 13 percent increase above current funding levels.

Alternative D has a relatively strong emphasis toward developed recreation at the expense of dispersed recreation opportunities—particularly unroaded nonwilderness. This results in a less diverse recreation opportunity spectrum than that of Alternative E.

With regard to geothermal leasing opportunities, Alternative D makes available 105,000 acres and is second only to Alternative C.

Alternative D is also more disruptive of the current lifestyles than Alternative E in that it reserves no lodgepole pine for personal use firewood collection. This means the personal use firewood collector will be competing with the commercial firewood purchasers for this resource and probably paying prices commensurate with true market values. Also, because of the lower first decade timber volumes in Alternative D as compared to Alternative E, this Alternative will result in fewer wood processing related jobs in the local communities. On the other hand, while both Alternatives have about the same amount of acres meeting the retention and partial retention visual management objectives, Alternative D captures some of the more important sensitive areas through its allocations of land. Finally, Alternative D provides enough mule deer habitat to enable it to exceed the Department of Fish and Wildlife population targets.

Alternative H

Alternative H has a PNV of $1027.2 million, sixth highest of the Alternatives, and $94.1 million lower than Alternative D. Alternative H schedules the harvesting of timber on a departure from nondeclining yield basis in order to maintain current harvest levels on a reduced land base. Alternative H also yields fewer discounted recreation benefits than Alternative D. The decrease in recreation benefits are primarily attributed to its provision of limited capacity for meeting projected future developed recreation needs.

Alternative H meets all of the RPA targets except for timber, which it just barely falls short of. Because of its relatively high volume of ponderosa pine during the first decade (second only to Alternative C), Alternative H returns the third highest revenues to federal and local governments in the first decade. However, it also requires the third highest budget (14.6 percent above the current funding levels).

Alternative H offers the second highest emphasis of undeveloped recreation of all the Alternatives, but only at the expense of a rather limited capacity for meeting future developed recreation needs.

Alternative H is also the second most restrictive Alternative with regard to promoting the leasing and future development of the Forest's geothermal resources.

With regard to nonpriced benefits, Alternative H ranks among the highest--possibly second only to Alternative G. Because of its relatively stable first decade timber outputs as compared to the current harvest levels, it causes only a modest downward pressure on the local timber employment base. The downward pressure results because Alternative H substitutes some lodgepole pine for the more labor intensive mixed conifer species offered in the current timber sale program. It also proposes setting aside 75,000 cords of personal use firewood per year which is a plus for maintaining the current lifestyles of Central Oregonians. In addition, it is second in its emphasis towards maintaining and enhancing visual quality on the Forest. On the negative side, it is last in terms of its projected mule deer populations and, as a result, fails to meet the State's population objectives for this species.

Alternative A (Currrent Direction)

Of the eight alternatives, Alternative A ranks seventh in present net value. Its PNV is $741.3 million, $285.9 million below Alternative H. Its low PNV ranking is due to the fact that of all the alternatives, the recreation benefits generated by Alternative A are the lowest.

In addition to its relatively low present net value, Alternative A also fails to meet the developed recreation, range, and timber related RPA targets. Despite this, it results in the second highest payments to counties because of its rich ponderosa pine and mixed conifer species mix during the first decade. It also requires the second lowest funding levels of all the Alternatives.

In addition to ranking fifth in terms of acres available for geothermal leasing opportunities, Alternative A also does not recognize the Newberry Crater as a Known Geothermal Resource Area.

In terms of nonpriced benefits, Alternative A ranks quite high. In fact, it serves as the standard with which to compare the other Alternatives with regard to some measures of the nonpriced benefits such as jobs, visual quality, and the abundant supply of personal use firewood. Implementation of this Alternative implies maintaining the status quo as far as the economy is concerned during the first decade, although future decades would witness changes. Alternative A ranks third in the amount of acres it proposes to manage for scenic quality, right behind Alternative H. On the other hand, Alternative A is the sixth lowest of all the Alternatives when it comes to projected mule deer populations, and fails to meet the State's population targets for this species. It also ranks relatively low in terms of both the amount of unroaded recreation and the amount of developed recreation which it provides, thus restricting the diversity of the recreation opportunity spectrum.

Alternative G

At $661.3 million, Alternative G has the lowest PNV of all Alternatives. This is due to its relatively low discounted timber and recreation related benefits. The timber benefits are low because Alternative G offers the lowest first decade timber sale program. The recreation benefits are low because of its relatively low capacity to provide for developed recreation opportunities, and the less than standard quality of recreation opportunities which it is budgeted to manage for.

Alternative G falls short of the range, developed recreation, and timber RPA targets. Yet, while Alternative G offers the lowest average annual first decade timber sale quantities, its returns to federal and local governments are higher than those of both Alternative B and Alternative D. This is due to its relatively slow conversion of mature lodgepole pine over the next few decades which permits a larger portion of the allowable sale quantity to be composed of the more valuable ponderosa pine and mixed conifer species. A positive aspect of the finances regarding Alternative G is its budget requirement. It is the only Alternative which proposes a budget lower than current funding levels (a decrease of 10 percent).

Alternative G is the most restrictive of all the Alternatives with regard to providing opportunities for the leasing and possible future development of geothermal resources on the Forest. It is also rather limiting in its provision of opportunities to meet future needs for developed types of recreation activities. Both of these are the result of its strong emphasis towards dispersed recreation and the maintenance of roadless areas in an undeveloped condition. This may lead to some conflict and polarization amongst local communities and other users of the Forest.

In terms of nonpriced benefits, Alternative G ranks highly in all aspects except economic stability in the local communities. Its implementation could result in the most downward pressure on job opportunities and income levels in the local economy. This is primarily due to its low timber sale program. On the other hand, it ranks highest in terms of the amount of personal use firewood available to the citizens of Central Oregon. It also ranks highest with regards to maintaining and enhancing visual quality and providing unroaded nonwilderness recreation opportunities. However, Alternative G falls short of the State's mule deer population targets, proposing lower population levels in the future than currently exist.

Identification of the Preferred Alternative

Alternative E was identified as the Preferred Alternative. It was selected as the Alternative which best maximizes the net public benefits in an environmentally sound manner.

Environmental Consequences

Implementation of any Alternative, including the Preferred Alternative, would affect the Forest's environment and resources. Both the short-term effects, meaning the effects over the first several decades, and the long-term effects which could occur four to five decades in the future, were considered. Both direct and indirect effects of implementing the Alternatives were also analyzed. Effects and outputs for each Alternative are shown in Table S-1.

The environmental consequences will be mitigated through implementation of Standards and Guidelines which establish levels of attainment and management policy and conduct in all resource management areas.

Effects That Do Not Vary Significantly Among Alternatives or Resources

Some Forest resources are protected and managed equally in all Alternatives through the application of the Standards and Guidelines. These resources include soils and water, Threatened and Endangered (T&E) plant and animal species, cultural resources, caves and other geological sites, and air quality. In all cases, these resources are mainly affected by the amount of timber that will be harvested in any Alternative, and to a lesser extent, the amount of recreation (and other) facilities that are developed.

Other resources are comparatively scarce within the boundaries of the Forest and therefore are not significantly affected by any Alternative. These include prime farmlands, wetlands and floodplains, and exploitable minerals. Where present, these resources are also protected and managed through the application of Standards and Guidelines.

Issues involving air and water quality, noise pollution, fire suppression, and the use of herbicides are also treated equally throughout all Alternatives. They vary among the Alternatives by the amount of timber that is proposed for harvest or treatment.

Effects on Resources that Vary Among Alternatives

Timber Management

The environmental effects of timber management are significant in all Alternatives. Harvesting of green sawtimber will directly affect a variety of resources, particularly in those Alternatives with timber harvest departures such as B and C. Timber harvest causes soil displacement and compaction, dust, smoke, and noise, all of which are short-term impacts on the Forest.

Timber harvest alters the structure and composition of forest plant communities. Even-aged management is applied in many situations and uneven-aged in others. Refer to Appendix I for more detail. As timber is harvested, understory preferred as forage for wildlife and livestock will increase but the availability of hiding cover for wildlife would be reduced. It also reduces the natural habitat for cavity dependent wildlife species such as birds and small mammals. Wildlife populations will decrease or increase depending on the availability of old-growth timber. Intensive timber management will change the structure of the forest from larger trees of mixed ages to a more uniform forest with smaller trees.

Road construction associated with timber management would increase opportunities for motorized dispersed recreation, Roading systems would increase access adjacent to Wilderness and roadless areas, reducing the Wilderness experience. Roading represents a long-term commitment of forest resources.

The cumulative effects of the accelerated lodgepole pine harvest, as proposed in most Alternatives, would be a significant decrease in wildlife cover. Because of the mountain pine beetle epidemic, visual quality in many areas would not be maintained. The magnitude of this accelerated timber harvest directly and indirectly affects all forest resources.

Range Management

Alternative C is most responsive to range management while B is the least. The other Alternatives meet the RPA program. The environmental consequences of range management in all Alternatives, however, are minimal. Livestock grazing can damage tree plantations, decrease forage, and cause soil compaction, particularly near salt licks and water sources. Livestock grazing alters native vegetation and can introduce non-native plant species.

Livestock in Wilderness and roadless areas can reduce the Wilderness experience for some users. Livestock grazing on public lands is a traditional part of the local economy.

Recreation Management

Opportunities to enjoy various types of developed and dispersed recreation vary significantly among Alternatives. Some promote developed site recreation and restrict dispersed recreation opportunities to existing Wilderness areas, such as Alternatives C and D. Alternatives G and H emphasize dispersed recreation. Others provide a mix.

The environmental consequences of recreation management reflect recreation use patterns. Developed campgrounds enable people living in urban environments to enjoy the outdoors. Overcrowding in popular developed campgrounds causes environmental degradation, usually in a localized area. Soil erosion and water contamination can occur. Motor vehicles create noise, air pollution, and compact or displace soil. Chances for people conflicts could increase. An emphasis on developed, motorized recreation could increase these conditions. Dispersed recreation could produce the same environmental consequences but on a lesser scale. Timber would not be available in Wilderness and unroaded recreation areas. Retention of the natural landscape in and around recreation sites would also limit timber harvest. As a result, concentrations of old-growth forest and a diverse plant community would be preserved in some areas. These could be damaged or destroyed by overcrowding in popular recreation sites. Facilities development and small-scale lodgepole pine harvest in many popular recreation sites may diminish the outdoor experience over the short term for some people but would improve the quality in the long term. Rangeland is not significantly affected by recreation management.

Wilderness and unroaded recreation areas would protect wildlife. Conversely, motorized recreation in developed and dispersed recreation areas would disturb and displace wildlife.

Recreation management has both indirect and direct social consequences. It provides opportunities for unconfined recreation in the outdoors. Recreation generates revenue and employment for the local and regional economy. Increased human pressure on the environment caused by recreation could decrease the quality and opportunities for recreation over the long term and require some new restrictions.

Wilderness Management

The environmental consequences of Wilderness management are the same in all Alternatives. Timber harvest is not permitted and livestock grazing is limited to areas established prior to Wilderness designation. Wilderness preserves natural ecosystems and large areas of old-growth forest. Wildlife habitat is protected.

An increase in the amount of human use of some Wilderness areas could result in environmental degradation. Popular campsites could become overused causing soil displacement, habitat damage, and water pollution.

Wilderness management also has social consequences relating to important human values and opportunities for primitive recreation experiences. Wilderness areas generate less revenue and create less employment than other areas of the forest because they are not available for commodity production.

Visual Management

Scenic quality is managed differently in various Alternatives. Alternative D emphasizes maintaining visual quality while C only protects areas along major travelways. Alternatives G and H protect and enhance significant areas for scenic quality while achieving other objectives. Alternatives B, E, and F emphasize scenic quality in relation to timber harvest.

Visual management limits the latitude of timber management activities. It can reduce the volume of harvest and increase costs in order to protect the landscape. Indirectly, visual management may generate less economic activity related to timber harvesting, though most Alternatives emphasize some level of commodity production where much logging activity is screened from view.

Recreation sites are usually in areas of high scenic quality which are protected so the consequences of visual management are minimal. It could increase the cost of construction of some facilities such as ski lifts and other nonconforming uses, particularly electronic sites and some geothermal facilities. Visual management would be similar in dispersed recreation areas but less restrictive.

The environmental consequences related to range, wildlife, wilderness, and old growth forest would be minimal. Visual management would tend to perpetuate all of these.

Visual management will protect scenic quality of uncommon or outstanding landscapes for the long term. This has important social consequences and values for many people.

Wildlife Management

The environmental consequences of wildlife habitat management also vary significantly by Alternative and treat species differently in each. Because big game hunting is a way of life in central Oregon, most Alternatives maintain or increase habitat for mule deer. Some provision is made to protect bald eagle and spotted owl habitat in Alternatives because they are threatened or sensitive species.

Wildlife habitat management does not significantly affect most resources. When timber and vegetation are managed to provide wildlife habitat, timber is produced below full potential, which indirectly affects the local economy. Localized deer and rodent damage tree plantations, resulting in higher reforestation costs. Prescribed burning for wildlife habitat may have short-term effects on scenic quality. An indirect effect of managing for some species is the perpetuation of old-growth forest.

Big game compete with domestic livestock for forage on rangelands. Fish stocking in Wilderness and roadless areas, and throughout the Forest, can affect human use patterns and levels. Wildlife is an important recreation attraction on the Forest and both its consumptive and non-consumptive uses contribute to the local economy and are an important part of local lifestyles.

Geothermal

The environmental consequences of geothermal exploration and development would affect a wide range of resources. Geothermal development such as that proposed under Alternative C would reduce the amount of timber available for harvest. Rangeland and other vegetation could be destroyed by the development of geothermal facilities in localized areas.

Geothermal development could produce soil erosion and compaction, air, noise, and water pollution, mostly in localized areas. Construction of facilities may affect visual quality and wildlife on both a short- and long-term basis. Geothermal development could indirectly affect recreation quality due to the noise, odors, and the visibility of the facilities. Geothermal leasing may discourage expansion of existing recreation facilities due to the potential of geothermal development and the effects described above. Geothermal development located directly adjacent to Wilderness and unroaded areas could reduce the quality of recreation experiences for some people.

Geothermal development would generate revenue for the local economy and employment.

Adverse Environmental Impacts that Cannot Be Avoided

Some adverse environmental impacts would inevitably occur as a result of the implementation of any Alternative. Most are temporary adverse effects that would be mitigated over the long term.

Soil would be displaced as a result of timber sales, slash treatment, and construction of roads, trails, recreation, and geothermal facilities. Overall, soil productivity would be maintained except for sites dedicated to roads, landings, recreation, and other facilities or uses which compact the soil or occupy a site.

Air quality may be temporarily degraded in localized areas as a result of prescribed fires and geothermal development. Short-term degradation of visual quality in recreation and scenic areas would occur as a result of harvesting mountain pine beetle infested lodgepole pine. Geothermal development would also affect scenic quality.

Areas suitable for undeveloped recreation (semiprimitive nonmotorized, or semiprimitive motorized) could become unsuitable for this type of recreation experience if they are allocated to other land uses. Management prescriptions scheduled for these other land uses could permanently destroy or temporarily modify attributes making them suitable for undeveloped recreation.

Irreversible or Irretrievable Commitment of Resources

Acres committed to facilities and roads constitute an irretrievable loss of vegetative production. Land committed to major roads and facilities could be considered to be an irreversible effect. Once developed, roadless areas committed to development would have an irreversible effect on Wilderness values associated with them.

Use of mineral resources such as cinders and gravel has both irretrievable and irreversible effects.

Coordination with Other Agencies and Local, County, State, and Federal Governments

Coordination with other agencies occurred throughout the planning process. The major local, County, State, and Federal agencies contacted include the City of Bend; Deschutes and Jefferson Counties; the Confederated Tribes of the Warm Springs Reservation; Oregon Department of Forestry; Oregon Department of Fish and Wildlife; Fish and Wildlife Service, Endangered Species Branch, U.S. Department of the Interior; and the Bureau of Land Management. The Preferred Alternative does not conflict with objectives of the aforementioned agencies with the exception of the

State's Forestry Program for Oregon. Alternative D meets their objectives but the Preferred Alternative is below the wood outputs projected by their plan.

Major Conclusions

When compared to the Current Direction Alternative, the Preferred Alternative places an increased emphasis on intensive recreation, habitat for threatened and sensitive wildlife species, accelerates the harvest of mature and overmature lodgepole pine, and increases the volume of timber to be sold. The Preferred Alternative permits leasing and exploration within portions of the Newberry Crater Known Geothermal Resource Area. Issues were addressed by establishing Management Areas or through standards, guidelines, and prescriptions. Present net value is higher than the Current Direction Alternative. Revenues to the government and counties are predicted to be slightly lower than the current levels. Effects on jobs and income are nearly the same as current levels.

HOW THESE DOCUMENTS ARE ORGANIZED

Each Package from the Deschutes National Forest should contain (1) the Draft Environmental Impact Statement (DEIS), (2) the Appendices to the DEIS, (3) the Proposed Forest Plan, and (4) Forest maps showing land use patterns for each of the alternatives. A general outline of the documents and a brief summary of the chapters follow:

In the DEIS:

- Summary of the Draft Environmental Impact Statement.
- Chapter I, "Purpose and Need", identifies (1) the laws and regulations used to direct the planning and environmental analysis process and (2) the public issues and management concerns about the land and resource management of the Deschutes National Forest.
- Chapter II, "Alternatives, including the Proposed Action", describes the Alternatives, explains their formulation, and compares them.
- Chapter III, "Affected Environment", presents the biological, physical, social, and economic setting of the Deschutes National Forest.
- Chapter IV, "Environmental Consequences", discusses environmental consequences, including unavoidable adverse impacts, and irreversible or irretrievable effects.
- Following these four Chapters are the: List of Preparers, List of Recipients of the DEIS and Proposed Forest Plan, Glossary of Terms, List of the References, and Index.

The Appendices contain technical discussions about various aspects of the Planning Process. They contain more detailed descriptions of some environments, analyses, and effects.

The Proposed Forest Plan contains information about how the Forestland and resources will be managed if the Preferred Alternative is implemented. Found here are the detailed standards and guidelines for management practices. It is important to remember that the Proposed Forest Plan is a proposal, and that the Draft Environmental Impact Statement is a draft. The information gained in the public review process can result in a modified or even new Preferred Alternative, and in a modified or substantially new Forest Plan.

The accompanying map packet contains maps of land management areas on the Forest for each of the alternatives. In addition to the material included in the DEIS, Proposed Forest Plan, and supporting Appendices, other process records are on file at the Supervisor's Office, Deschutes National Forest, 1645 Highway 20 East, Bend Oregon, 97701. These include records documenting the Timber Land Suitability Determination; process record material for recreation, wildlife, range, diversity; and yield table development. This information is available upon request. Regional direction for topics such as minimum management requirements (MMR's) is available at the USDA, Forest Service, Regional Office in Portland, Oregon.

CHAPTER I

PURPOSE AND NEED

Introduction

This Draft Environmental Impact Statement (DEIS) discloses eight Alternatives and identifies a preferred alternative (which is the "proposed action"). These are alternative ways of managing the land and resources of the Deschutes National Forest for the next 10-15 years. This DEIS also describes the environment which would be affected, and the environmental consequences of implementing each of the alternatives. Each alternative presents a different way to address local, regional, and national public issues and management concerns, provides for use and protection of resources, and fulfills legislative requirements. Each alternative generates a different mix of goods and services from the Deschutes National Forest. The alternatives were evaluated to determine which best provides the level of multiple uses, goods, and services that maximizes long-term net public benefits in an environmentally sound manner. (Net public benefits is the overall value to the Nation of all outputs and positive effects less all the associated Forest Service inputs and negative effects whether they can be quantitatively valued or not.) The Forest Service determined that Alternative E best accomplishes these objectives.

The preferred alternative is the basis for the accompanying "Proposed Deschutes National Forest Land and Resource Management Plan" (Proposed Forest Plan) document. The purpose of the Forest Plan is to direct and guide all natural resource management activities on the Deschutes National Forest. Preparation of the Proposed Forest Plan is required by the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA), plus the associated National Forest System Land and Resource Planning Regulations (36 CFR 219).[1]

Preparation of an Environmental Impact Statement, disclosing a preferred alternative and alternatives to it, is required by the National Environmental Policy Act of 1969 (NEPA) and the Council on Environmental Quality NEPA Regulations (40 CFR 1500), in order to implement the Forest planning provisions of NFMA (36 CFR 219). For purposes of disclosure under NEPA, this DEIS and the accompanying Proposed Forest Plan are treated as combined documents.

The Environmental Impact Statement is required because the Forest Plan is a major Federal action with a significant effect on the quality of the human environment. Its purpose is to provide decisionmakers with an environmental disclosure sufficiently detailed to aid in the selection of management direction for the Forest. Equally important, its purpose is to make information of the alternatives' environmental impacts available to the public, and to encourage public participation in the development and refinement of that information.

Planning Process

To put Forest Planning in perspective, it is important to have a general understanding of the overall Forest Service planning process. As required by RPA, NFMA, and the related implementing regulations cited above, the Forest Service has a three-level, integrated, planning process. At the National level, the RPA Program establishes long-range resource objectives based on the present and anticipated supply of, and demand for, various resources. A portion of each National resource objective included in the RPA Program is distributed to each of the nine Forest Service Regions in the Nation.

At the Regional level, a Regional Guide is developed. The Regional Guide presents the distribution of its portion of the National objective to each National Forest. In addition, the Regional Guide establishes Regional management standards and guidelines. "The Regional Guide for the Pacific Northwest Region" of May, 1984, provides this direction for the Deschutes National Forest. If the Regional Guide is amended or revised, the Forest Plan may also be amended or revised.

At the National Forest level, a proposed Forest Plan is prepared. A range of resource objectives are considered as alternatives; one, or more, of these alternatives meets or exceeds the current RPA Program resource objectives displayed in the Regional Guide. Study of the outputs and effects of the alternatives provides valuable information to the

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[1] 36 CFR 219 refers to Part 219 of Title 36 of the Code of Federal Regulations.

Regional and National programs regarding Forest capabilities and programs.

The planning process is a continuously repeating process in that the information from the Forest level flows up to the National level, is incorporated in the RPA Program, and then flows back to the Forest level. The information regarding resource capacities and demands provided by the National Forest is incorporated in the RPA Program and then is submitted to Congress as an aid to determine appropriation and authorization of the agency's annual budget. Since allocations in the annual budget have a major effect on Forest management activities, many of the Forest's actual outputs and environmental effects are ultimately determined in large part by the annual budget. But, through the overall planning process, the annual budget can be responsive to needs and capacities on the Forests.

The RPA Program (and often Regional Guides) is updated every 5 years. The Forest Plan is reviewed every 5 years, and is ordinarily revised on a 10-year cycle, or when changes in the RPA Program significantly affect Forest programs. It is revised at least every 15 years. It also may be revised whenever conditions or demands in the area covered by the Forest Plan change significantly. This process ensures that the Forest Plan is responsive to changing conditions. The Plan and DEIS project outputs and effects for 5 decades to indicate the long term implications of continuing with the Plan.

The planning process specified in the NFMA implementing regulations and the environmental analysis process specified in the CEQ regulations were used in developing this DEIS and the accompanying Forest Plan. The planning steps used are:

1. **Identification of issues, concerns, and opportunities.** What are the public and Forest Managers concerned about?)
2. **Development of planning criteria.** (These are the rules used to approach this complex task.)
3. **Inventory data and information collection.** (What and how much is out there?)
4. **Analysis of the management situation.** (What is the capability of the Forest and is there need for establishing or changing management direction?)
5. **Formulation of Alternatives.** (What are different ways of managing the Forest to address the issues?)
6. **Estimate effects of Alternatives.** (What changes in the physical, biological, social, and economic environment are projected?)
7. **Evaluation of Alternatives.** (What goods and services would be provided by each Alternative and how do they respond to the issues?)
8. **Selection of Preferred Alternative.** (Which is the environmentally preferred Alternative?)
9. **Plan implementation.** (How will we do business under the approved FEIS and Forest Plan?)
10. **Monitoring and evaluation.** (Are we meeting the objectives of the Plan and in compliance with the established direction?)

The results of the environmental analysis are documented in this DEIS. It ensures that environmental information is available to public officials and citizens before decisions are made and before actions are taken.

All of the documents and files that chronicle the planning process (including environmental analysis) of the Deschutes National Forest are available for review at the Supervisor's Office, 1645 Highway 20 East, Bend, Oregon 97701. These documents and files, or "planning records", contain the detailed information and decisions used in developing this DEIS and the Proposed Forest Plan. The planning records are incorporated by reference at appropriate points in the text and appendices of this DEIS and the Proposed Forest Plan.

This DEIS and the Proposed Forest Plan are being circulated for review and comment. Some planning steps may be repeated if necessary to respond to public comment. The resulting Final Environmental Impact Statement (FEIS) will be used by the Regional Forester to make a decision regarding approval of the Forest Plan. The decision will be documented in a Record of Decision which will be available to the public.

Upon implementation, the FEIS will be used for "tiering" in accordance with the CEQ Regulations. Tiering means that Environmental Assessments prepared for projects arising from the Forest Plan will refer to the FEIS and associated documents rather than repeat information. The environmental documents for specific projects will concentrate on issues unique to the projects.

The Forest Plan supercedes or incorporates all previous land management and resource management plans prepared for the Deschutes National Forest. Upon implementation, Forest management activities will comply with the Forest Plan. Appropriated budgets, contracts, and other instruments of the use and occupancy of National Forest System lands and resource uses must be in conformance with the Forest Plan as soon as possible (36 CFR 219.10 (e).

A new resource inventory is now in progress. If a Final Environmental Impact Statement (FEIS) has been filed before the new inventory has been completed, the outputs for the Proposed Action Alternative may be adjusted to reflect the results of the new data. Depending on the significance of the adjustments, the Forest Plan would be revised or amended.

Table I-1 shows the existing plans that would be affected by approval of the FEIS.

A Glossary defining terms, units, and abbreviations is located at the back of this document. A list of references cited in the DEIS is also provided. The reader will find it useful to consult the land use maps for each alternative when reviewing this DEIS. The maps are in a separate envelope accompanying this DEIS.

Forest Overview

Map I shows the location of the Deschutes National Forest. A map showing the vicinity around the Deschutes National Forest can be found in the Summary part of the document.

The Deschutes National Forest is a I.6 million acre wonderland of sculptured peaks, tumbling waterfalls, crystal clear lakes and rivers, miles of timbered lands, hundreds of species of wildlife and fish, five designated Wildernesses and a specially classified recreation area, and possibly the best variety of volcanic formations anywhere on this continent.

The Cascade Range on the western edge of the Forest provides a scenic backdrop for the flat, desert areas on the eastern fringe of the Forest. Elevations range from 2000 feet at Lake Billy Chinook to 10,497 feet at Mt. Jefferson, the second tallest peak in Oregon. Diamond Peak, Mt. Washington, Mt. Jefferson, Three Sisters, and Mt. Thielsen Wildernesses cover 182,506 acres on our National Forest and the Oregon Cascade Recreation Area covers 42,656 acres on the Forest.

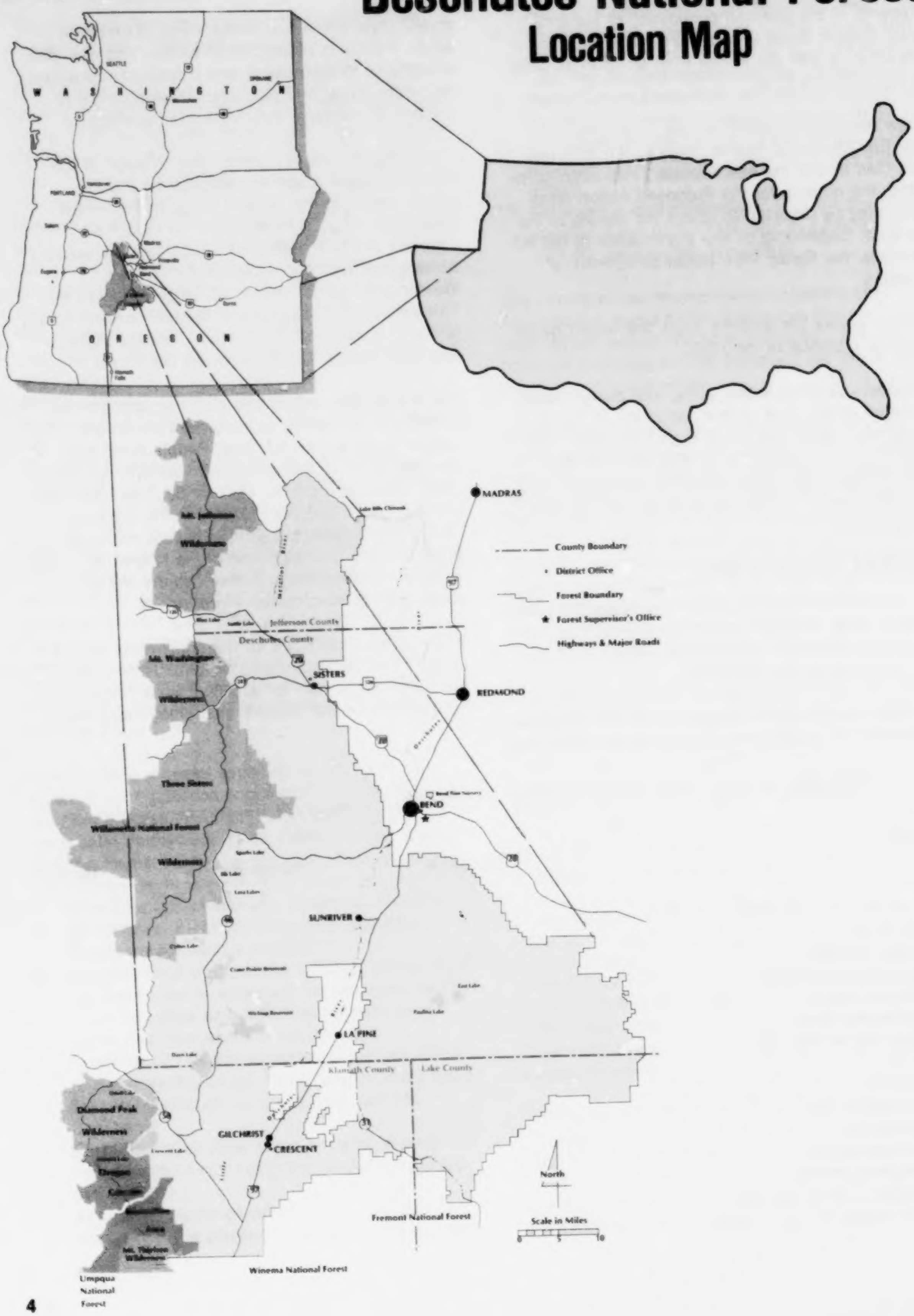
The sunny, dry climate and clean air and the rich diversity of recreation opportunities attract over 2.5 million visitor days each year. People come from all over the world to fish and hunt; hike and mountain climb; camp and picnic; sail, canoe, and water ski; explore caves; and cut firewood in the summer. They come to downhill ski nearly year round on 9,065 foot Mt. Bachelor, one of the largest ski areas in the Pacific northwest. Cross country skiing and snowmobiling are popular winter sports.

Water is the focal point for many activities on the Forest. The Deschutes and Metolius Rivers, which are nationally known for excellent trout fishing, flow through the Forest. Visitors also enjoy these rivers

Table I-1 Deschutes National Forest Plans that Would be Affected

Update/ Document Title	Continue	Terminate	Revise
Timber Management Plan		X	
Deschutes NF Land Management Plan, 1978		X	
1972 Fire Plan			X
Range Allotment Plan	X		
Three Sisters & Mt. Jefferson Wilderness Plans		X	
Land Adjustment Plans			X
Lava Butte Special Interest Plan			X
Swatter EA		X	
Off-Road Vehicle Plan			X
Tree Improvement Plan	X		
Geothermal EA's	X		
Research Natural Area Establishment Reports	X		
Existing Special Use Permits and Leases will be changed on a case-by-case basis	X		

Deschutes National Forest
Location Map


WASHINGTON
SEATTLE
SPOKANE
PORTLAND
Vancouver
Salem
Eugene
Madras
Redmond
Bend
Burns
Klamath Falls
OREGON
MADRAS
Lake Billy Chinook
Mt. Jefferson
Wilderness
Metolius River
Blue Lake
Suttle Lake
Jefferson County
Deschutes County
Mt. Washington
Wilderness
SISTERS
REDMOND
Deschutes
Three Sisters
Willamette National Forest
Wilderness
Bend Pine Nursery
BEND
Sparks Lake
Elk Lake
Lava Lakes
SUNRIVER
Odell Lake
Crane Prairie Reservoir
Wickiup Reservoir
East Lake
Paulina Lake
LA PINE
Davis Lake
Klamath County
Lake County
Diamond Peak
Wilderness
Crescent Lake
GILCHRIST
CRESCENT
Little
Oregon
Cascades
Area
Mt. Thielsen
Wilderness
Umpqua
National
Forest
Winema National Forest
Fremont National Forest
County Boundary
District Office
Forest Boundary
★ Forest Supervisor's Office
Highways & Major Roads
North
Scale in Miles
0
5
10

for their many rafting challenges, natural beauty, wildlife watching, and streamside camping. Also scattered throughout the Forest are over 300 mountain lakes and several reservoirs. Stands of ponderosa pine, lodgepole pine, mountain hemlock, Douglas Fir, white fir, grand fir, and Shasta red fir grow on 71 percent of the Forest. Although many acres were harvested on the Forest in the early 1900's, old-growth stands can still be found and are being perpetuated. Over 212 million board feet of timber were harvested in 1984. The 719,000 acres of usable rangeland were used to graze 29,000 animal unit months of cattle and sheep in 1984. The nearly 350 species of fish and wildlife are enjoyed by hunters and fishermen and by wildlife watchers alike. The Bald Eagle which is Federally listed as threatened and the northern spotted owl which is listed as sensitive live on the Forest. The Forest has a significant population of osprey which has become a symbol for the Deschutes National Forest.

Spectacular volcanic activity occurred as recently as 1300 years ago when obsidian flowed from Newberry Volcano. Newberry Volcano, which is 500 square miles in area, collapsed to form Newberry Crater during the ice age. It is the largest such volcano in Oregon. In recent years Newberry Crater has become the source of national interest due to its great potential for geothermal energy. Other areas of special interest are Lava Cast Forest, where tree molds or casts were formed by molten lava flowing through a timber stand. It is one of the finest cast collections in the western hemisphere. Lava River Cave is a mile long lava tube and one of the longest in the northwest.

The Forest lies mostly in Deschutes County but extends into Jefferson County on the north and into Klamath and Lake Counties on the south. Over 1.85 million acres lie within the Forest boundary; of these, 1.6 million acres are National Forest lands.

The mainstays of the local economy are recreation and timber. The largest cities in the area are Bend and Redmond. Madras, Sisters, LaPine, Crescent, Sunriver, and Gilchrist are other important population centers. Forest headquarters and two Ranger District offices are located in Bend. Ranger District offices are also located in Sisters and Crescent. The Redmond Air Center, located at the Redmond Airport, and the Bend Pine Nursery are administered by the Forest Supervisor of the Deschutes National Forest.

Principal highways serving the area are U.S. 97, a north-south route, and U.S. 20, an east-west route. Other transportation includes a commercial busline and Roberts Air Field near Redmond, which offers commercial airline services. A railroad serves the area, but passenger service is only provided at Chemult, 70 miles south of Bend.

The Forest setting is described more fully in Chapter III, "Affected Environment".

Scope of Issues and Concerns to be Addressed

Introduction

The Deschutes National Forest consists of a complex ecological environment which can be managed to produce different amounts of goods and services and for different land uses. Different people and groups prefer to see the Forest managed in different ways. But, because all the resources, land uses, and environmental conditions of a Forest are interconnected, managing to emphasize some aspects of the Forest causes changes in others and tradeoffs become necessary. There are practical and natural limits to what a Forest can provide.

An important Planning task involves analyzing different ways to manage the Forest to determine the implications to the environment and for human uses of it. The different emphases in goods, services, uses, and environmental conditions that people want and do not want, are used to identify the alternative mixtures of management practices which are formulated and analyzed.

These preferences of individuals and groups, and the physical, biological, and legal limits of Forest management are present in the public issues and management concerns which guide the Forest planning process.

A public issue was defined as being a subject or question of widespread public interest relating to management of the National Forest System.

A management concern was seen as being an issue, problem, or condition which constrained the range of management practices identified by the Forest Service in the planning process. Other influences on formulating alternatives are the concerns managers have in meeting Forest management needs. Also influencing the formulation of Alternatives was the need to meet legal and regulatory requirements.

A third component influencing alternatives came from the various resource use and development opportunities suggested by both the public and the Forest Service. These opportunities were the basis of many of the issues and concerns identified here.

The opportunity to preserve or develop and use the resources of the National Forest was the focus of many of the Forest's programs, and the principal focus of the management alternatives developed here.

Identification of Issues

The first step in the planning process was to identify public issues and management concerns. It was an important step because these issues and concerns were used to guide the planning process and to ensure that the resulting Land and Resources Management Plan would provide appropriate and effective management direction. An extensive and continuing process was used to assemble the issues and concerns. Public meetings, newsletters, local news media, and many personal contacts by Forest Service officials were used to gather the issues. Those contacted included a wide cross section of individual members of the public, adjacent private landowners, adjacent National Forests, State and local government agencies, local industry and conservation groups, and Native Americans.

Many of the 32 issues that were identified early in the planning process did not receive public comment during the review of the DEIS for the Deschutes National Forest Land and Resource Management Plan which was released in November 1982. (The 1982 DEIS was never completed due to the roadless area issue and new planning requirements that developed.) As a result, all issues were reevaluated to determine whether they were still issues and therefore would be carried forward in the process. The criteria were: whether (1) there was high or long term public interest, (2) whether future options were being foreclosed, or (3) whether parcels of land involved were small. Therefore, some issues such as those dealing with electronic sites, and cinder pits, coordination with private landowners, and the role of fire management were dropped. Public interest, is not high or long term, future options are not being foreclosed, and only small parcels of land are involved. The issue concerning recreation residences was also dropped. Reasons for keeping them in some Alternatives and not in others did not surface. A limited number of acres of land are involved and most of the public interest was limited to the cabin owners. See Appendix A for more information.

Relationship of Issues

Treatment of the issues does not necessarily cause conflicts with other issues. In fact, treatment of one issue can complement another issue. For example, the mountain pine beetle epidemic in lodgepole pine can be addressed in a manner that complements the firewood issue if some proportion of the dead material is made available for personal use firewood. Another example would be to sell all of the lodgepole pine to maximize revenues to the government and hence the counties and local communities. Harvesting mature lodgepole pine can be used to improve and perpetuate bald eagle nesting habitat where the lodgepole is competing with ponderosa pine. Lodgepole stands do not provide the type of trees suitable for eagle nesting sites while ponderosa pine stands do. Harvesting lodgepole pine has the potential to increase the production of forage which can be used by livestock, deer, and elk.

Recreation and visual quality are the fabric of local life styles and economies. A Forest with a broad recreation base in a pleasing environment could be an asset to the central Oregon area while still providing goods and services necessary for stable timber-based industries. One mix may favor economics while a different mix may favor nonpriced values.

Developing some roadless areas could increase wood production or increase the opportunities for geothermal production. Retaining some roadless areas in an undeveloped condition minimizes conflicts with habitat for threatened or sensitive wildlife species and other uses.

The following section first states the issue and then explains how it relates to the other issues.

- **How should the Forest consider local and regional economies, lifestyles, and population levels in managing Forest lands?**

The economy and lifestyles of many local and regional people and businesses are tied to the Forest in many ways. Both tourists and permanent residents are attracted to the wide variety of recreation opportunities available on the Forest. Most often they come to hunt, fish, ski, camp, or boat. Some combine these activities with other recreation pursuits associated with recreation resorts.

The Forest provides wood for a significant forest products industry which provides jobs and contributes to a way of life for many people. Since many people use wood as their primary source of home heating, gathering firewood has become a part of the Central Oregon way of life. The issue concerning local and regional lifestyles and economies is at the center of all other issues. The way each of the following issues is treated has a bearing on this issue. For example how the mature lodgepole pine is treated has a bearing on firewood and the forest products industry which in turn affects the economies and lifestyles.

- **How much timber should be harvested and on what schedule?**

Many people are concerned that the Forest might be developed as a tree farm with regard only for monetary and commodity values. The other side of the issue is that too much area might be tied up for uses other than timber production, thus diminishing the base for the forest products industry. The schedule of timber harvesting is also a concern. How fast should the remaining mature and old-growth forests be harvested and converted to younger managed stands? This issue is directly linked to the lodgepole pine issue which follows.

- **How should the Deschutes, Winema, and Fremont National Forests manage the lodgepole pine stands which are infested with mountain pine beetles and stands which are susceptible to infestations?**

The three National Forests are coordinating the management of lodgepole pine stands on approximately 500,000 acres of land. The stands are mostly in a mature or old-growth condition. The older stands are infested with mountain pine beetles to the point that the situation is best described as an epidemic. Some stands are dead, some are dying, and others are susceptible to attacks. It is predicted that 80 percent of the mature stands, covering approximately 225,000 acres on the Deschutes National Forest, will be destroyed by the beetle by 1995.[2]

The issue regarding lodgepole pine has strong ties to other issues and the treatment of it could create new issues. The lodgepole situation has created an abundance of firewood and has been one of the catalysts to the growth of wood burning stoves for home heating. The main question regarding this issue is how fast to treat the mature lodgepole pine and what to use it for. If industry uses a large amount of it, then less will be available for personal or commercial firewood.

If large amounts of lodgepole pine are harvested in the next 10 years, then how much ponderosa pine should be harvested? Ponderosa pine is the most important species for timber industry so the amount of ponderosa pine in relation to lodgepole pine is of concern. How rapidly the lodgepole pine is treated is also the source of a new issue that is beginning to develop. As dying stands are harvested, hiding cover for big game is being reduced. There is concern that this increases the vulnerability of deer during the fawning season and the hunting season. The thrust of this issue will be how to provide for the overall security of big game if hiding cover is reduced.

This issue is also related to recreation and visual quality. Stands along heavily used roads and in campgrounds are being killed. If the stands are treated to protect them or start new stands the visual quality will be reduced as well as the recreation experience.

- **How should the Forest plan to meet future demands for use of wood as an energy source?**

Nearly 60 percent of the homes in the central Oregon area are using wood to help heat their homes. An estimated 60,000 cords of personal use firewood are being consumed annually. Various commercial operations are using an additional 50,000 cords annually. These 110,000 cords equate to 9,000 loaded log trucks or enough lumber to build 3,900 single family homes per year. Most of this fuelwood is lodgepole pine. With the current use levels of firewood, regular timber sales, and the mountain pine beetle attacks, it is possible that the primary source of easily accessible fuelwood as we know it today will be gone by 1995 to 1997. Several assumptions must be made in order to properly address this issue. One is that demand would remain near current levels and another is that firewood cutters would be willing to shift to sources other than lodgepole pine for firewood.

A part of the issue dealing with wildlife population levels is related to the firewood issue. A component of habitat for cavity dwelling species is dead trees. With the easy access on the Forest and high demand for firewood, this habitat can be affected.

- **How should the Forest provide for present and future developed recreation?**

Developed recreation, i.e., recreation occurring within a site or facility, takes on many forms, ranging from the Mt. Bachelor Ski Area to small isolated picnic grounds. Demand for more camping, boating, and other recreation pursuits requiring facilities and resulting in concentrations of people is continuing to grow. Destination resorts adjacent to the Forest also attract many recreationists to the area. Two questions need to be addressed—which areas should be managed as developed recreation sites and how many acres should they include. Many of the attractive recreation areas are associated with lakes, rivers, and streams. Development may introduce potential for water pollution, could alter riparian or wildlife habitat, or result in structures which alter the natural beauty of an area. An increase in developed recreation sites would allow more people to enjoy the Forest.

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[2] Dolph, Robert E. and Filip, Gregory M. "Forest Insect and Disease Activity on the Deschutes National Forest and Guidelines for Preventing and/or Reducing Their Losses. Pacific Northwest Region, 1980.

This issue is related to the issue regarding lifestyles since recreation is an important aspect of living in Central Oregon. It also makes contributions to revenues and employment. There is also a relationship between this issue and habitat for some wildlife species. Habitat for bald eagles and osprey often occurs in the same areas which could provide good developed recreation opportunities. How the vegetation is managed, particularly trees, could affect the issue regarding the level of timber harvesting.

- **How can the Forest keep pace with expanding demands for dispersed recreation?**

Hiking, rafting, fishing, snowmobiling, sailing, hunting, driving for pleasure, caving, and mountain climbing, are all popular dispersed recreational activities. Some recreational activities occur in exclusive areas of the Forest such as designated Wilderness. Others, such as cross country skiing and snowmobiling, occur in the same areas; and conflicts between users can and do occur. How to zone the Forest to provide for dispersed recreation activities while minimizing conflicts is the heart of this issue.

An aspect of dispersed recreation is "undeveloped recreation". This is recreation without roads, campgrounds, or other developments. This type of recreation is currently available in existing Wilderness, the Oregon Cascade Recreation Area, and roadless areas. In this sense, the issue is related to the roadless area issue since development of roadless areas could reduce the opportunity for undeveloped recreation.

- **How can the Forest maintain scenic beauty while providing for timber production and other goods and services?**

The high recreational values of the Forest are directly linked to its beautiful scenery. Viewing volcanic peaks along the Cascade Crest, large ponderosa pine trees along major roads, and free flowing rivers are all part of the recreation experience. Views from lakes and campgrounds can affect the experience of the recreationist. Many people prefer to view natural appearing landscapes rather than ones where timber harvesting dominates. The key to this issue is to determine which areas should be managed for their natural beauty. Another aspect of the issue is how to manage areas with high scenic values.

- **How should the Forest manage roadless areas?**

The passage of the Oregon Wilderness Act in 1984 left the Forest with 145,142 acres of roadless areas. The Act released these areas for multiple use management. The thrust of this issue is whether these acres should remain roadless. Public comments on individual roadless areas showed a high level of concern for keeping some areas in a roadless condition because of the unique values associated with them.

The roadless areas are related to the other issues in that some have potential resources such as geothermal, timber, and motorized recreation, which would require roading to utilize or have access to these resources.

- **How should the Forest identify and protect its cultural resources?**

Over 600 scientifically and historically valuable cultural resources have been identified on the Forest. Over 50 new sites, mainly comprising prehistoric Indian campsites, are found each year as a result of the Forest's cultural resource inventory program. Cultural sites located in project areas such as timber harvest units or recreation sites are usually protected by designing activities around them, though a few mitigation projects have occurred. Known sites are checked periodically in an attempt to prevent illegal artifact collecting and vandalism which is a serious problem on the Forest. Cultural resources are an issue in the sense that many people, especially local residents, are concerned about how many and how adequately cultural sites are being preserved and protected in the face of all the ground-disturbing projects and cultural resource vandalism that occur on the Forest.

This issue is directly related to the issue of how much timber should be harvested and on what schedule since that activity affects more area than other activities.

- **How should the Forests manage habitat for threatened, endangered, or sensitive species?**

The Bald Eagle, which is listed by the U.S. Fish and Wildlife Service as a threatened species, is present on the Forest. Fifteen to 20 pairs of bald eagles are currently nesting on the Forest. The habitat could potentially support 50 pairs. Nesting and feeding areas are important habitat for eagles. The Forest also has habitat for the northern spotted owl which is classified as a Sensitive species. Currently 11 pairs of spotted owls are present and there is potentially habitat to support 12 pairs. The issue is how many pairs of eagles and owls we should provide old-growth habitat for. The Peregrine Falcon, which is listed by the U.S. Fish and Wildlife as an endangered species, has been reported on the Forest; but no nest sites have been located.

Sixteen plants classified as Sensitive Species are known to exist on the Forest, and the presence of 8 others is suspected.

- **What should wildlife populations be?**

The public, the Forest, and the Oregon Department of Fish and Wildlife are concerned about several species which are listed below with their currently estimated populations. They are: mule deer (20,300), elk (500 to 700), and osprey (125) pairs. Other species of concern include goshawks, pine martens, and woodpeckers. The question for all the species is what level of emphasis should the Forest place on maintaining or improving habitat for these species?

This issue is related to the timber issue in that providing habitat can be done by using different techniques including timber management. When the trees are manipulated to achieve the desired habitat conditions, timber yields can be reduced below their potential. This issue is also related to the recreation issue since wildlife is a source of recreation or it can restrict it in order to protect wildlife and its habitat.

- **What level of old growth should the Forest manage for?**

Old growth is important to many people for reasons ranging from concerns about wildlife, genetics, and scenic quality. Just keeping some of the old growth is important to people as well as protecting future options. The thrust of this issue is how much old growth should be provided and how it should be distributed.

This issue relates to the issue regarding the spotted owl and bald eagle. Habitat for those species is old growth or old trees. By providing for habitat for those species, some old growth will occur. The same is true for undeveloped recreation where natural processes are allowed to operate. Providing for old growth affects the timber issue since harvesting of timber is normally not compatible with old-growth goals.

- **Can the Forest meet the assigned Resources Planning Act targets?**

The Regional Guide established targets for the Deschutes National Forest of 214 million board feet (MMBF) of timber, 36,000 animal unit months (AUM's) of domestic livestock grazing, 2050 thousand recreation visitor days (MRVD's) of developed recreation, 1930 MRVD's of dispersed recreation, and 1275 acres of wildlife habitat improvement. The Forest must determine if it is capable of producing these outputs within acceptable social and environmental limits.

Meeting the Resources Planning Act targets is directly related to the timber, recreation, and wildlife issues. It is also indirectly related to some of the other issues such as firewood and roadless areas.

- **What areas on the Forest should be made available for geothermal leasing and development?**

The Deschutes National Forest is considered to have some of the greatest potential for geothermal resources of any area in the Western United States. Approximately 350,000 acres have already been leased. The Newberry Crater is designated as a Known Geothermal Resource Area (KGRA). It is also a National Natural Landmark. Hot fluids have been located near the surface within the Crater. The interior of the Crater is an important recreation area with two large lakes known for their fishing. Campgrounds and resorts are located adjacent to the lakes. The area is also a popular winter sports area with snowmobiling and cross country skiing. There is an active bald eagle nesting territory within the Crater. Numerous unique geological features are also found within the Crater such as world famous obsidian flows. There are also other areas on the Forest which could be leased that are currently not leased. The main thrust of this issue is where and under what conditions leases should be issued and how to protect recreation, visual, wildlife, water quality, and other resource values.

This issue is also related to the roadless area issue since some of the highest potential for geothermal development lies within some roadless areas.

- **How should the Forest manage key roads, particularly those lower standard roads that cross the Cascade Crest?**

The Windigo Pass, Waldo Lake, irish-Taylor, and Todd Lake to Three Creeks Lake roads have been the center of controversy in the past. The primary issues have been whether the roads should be improved to provide additional vehicle use and more direct routes to points west of the Cascades. All of the roads are currently adjacent to Wilderness, the Oregon Cascade Recreation Area, or roadless areas. Improving the roads could affect use levels in these areas. The Windigo Pass and Waldo Lake roads have been considered as possible future highways.

- **How should the Forest protect vegetation from damage by forest pests?**

Pesticides currently used on the Forest include Big Game Repellent (BGR) and strychnine alkaloid. BGR is a deer repellent made of eggs to protect newly planted trees. It is applied to approximately 5,000 acres per year. Strychnine is applied underground to reduce gopher populations in some plantations which receive heavy tree loss from gophers. This also is applied to about 5000 acres annually. Herbicides to control vegetation were applied to about 800 acres annually prior to the Court enjoining the Forest Service from the use of herbicides. No insecticides have been used recently and are not being used to control the mountain pine beetle. Insects such as spruce bud worm are present both on National Forest land and on adjacent lands and could pose a future threat. The result could be an expanded need to consider the use of insecticides in the future. The thrust of this issue is whether use of pesticides to control pests is appropriate or whether alternative treatments should be used.

- **How should the Forest manage its lakes, streams, and wetlands to prevent degradation?**

Water quality monitoring conducted over the past 10 years by the U.S. Forest Service, Department of Environmental Quality, and the Department of Fish and Wildlife has shown the surface waters on the Deschutes National Forest to be well within the levels specified by the State water quality standards for the Deschutes River basin. The guidelines and management policies which have been used in the past to guide management along streamsides have prevented significant damage and the riparian zones are in good condition. Past evaluations of channel stability on the Deschutes NF showed that the streams have small localized instability problems but are in good condition generally. This is an issue because people who live and visit the area place great value on the existing level of water quality and want to protect and maintain it.

- **To what extent should the Forest enhance or maintain soil productivity and control erosion?**

Due to the volcanic origin of the soils on the Deschutes NF and the gentle terrain, there are very few of the traditional soil problems. The Soil Resource Inventory for the Forest shows that the majority of the area is rated as low to moderate in terms of surface erosion potential. There are small localized instances of mass failure but these are isolated and very rare. Compaction is not a problem on most of the Forest due to an overburden of pumice. There are compaction problems on the north portion of the Forest where the soils are more developed and weathered. Displacement of the surface soils is a problem due to the natural lack of cohesion of the coarse textured surface soil particles. Generally, the issue dealing with soils is tied to the protection of the surface soil and maintenance or improvement of productivity wherever possible.

CHAPTER II

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

This chapter is the heart of the Environmental Impact Statement. It:

- summarizes the process used to develop a full range of Alternatives and to analyze them;
- describes each alternative in terms of its purpose and management emphasis; and
- compares and analyzes the physical, biological, social, and economic outputs and effects of each alternative.

This chapter draws on material from later chapters. Chapter III describes the Affected Environment. Chapter IV presents the Environmental Consequences.

This DEIS displays eight different ways of managing Deschutes National Forest lands and resources. Each way or alternative is a unique combination of land uses, management prescriptions, and activity schedules. Different mixes of goods and services for the public, and different combinations of resource outputs, land uses, and environmental effects result.

The alternatives explore a variety of ways to respond to the public issues, management concerns, and resource use and development opportunities identified throughout the planning process.

"Benchmarks" are presented and discussed several times in the chapter. Benchmarks are analytic bases from which the alternatives were developed. They were used to analyze certain relationships under special economic and resource production assumptions. Their character and use will be discussed in the next section.

Alternative Development Process

Overview

Basis for Alternative Development

Alternatives were developed using Part 219.12 (e) and (f) of Title 36 of the Code of Federal Regulations which require analysis of various minimum and maximum production levels and economic factors. They also require that some alternatives would manage the National Forest to maximize the production of priced commodities, such as timber and range, while other alternatives would maximize the provision of unpriced amenities, such as dispersed recreation and environmental qualities. One alternative ("No-Action") reflects current resource outputs, while another alternative (RPA) reflects the objectives of the Forest Service National program. From this broad range of Alternatives, the Regional Forester has a basis for identifying the Preferred Alternative.

Formulation of Alternatives

Formulating a broad range of reasonable management alternatives for a National Forest is an extensive and complex process. Each alternative is a combination of land uses, Forest management activities, and schedules. Alternatives must consider the resource capabilities (both the limitations and the potentials) of the many different areas of the Forest. Each alternative is designed to manage the land to achieve some goals and objectives. Some of these objectives, such as maintaining air and water quality, are common to all alternatives; other objectives, such as the mix and amount of resource outputs, vary among the alternatives.

The maximization of net public benefits is a goal of the Forest Planning process and a consideration in the development of Alternatives. Net public benefits is the overall value to the Nation of all outputs and positive effects (benefits) less all the associated Forest Service inputs and negative effects (costs), whether they can be quantitatively valued or not. Conceptually, "net public benefits" is the sum of the present net value of priced outputs plus the net value of all non-priced outputs. Net public benefits are maximized by the alternative which has the greatest excess of benefits over costs. A major objective of the Forest Planning process is to provide information that helps determine which alternative provides the mix of outputs and effects that best responds to the issues and concerns while maximizing the net public benefit of managing the National Forest.

When dealing with net public benefits two general types of outputs and effects are addressed by the Alternatives. They are priced outputs such as timber which can be exchanged in the market place. The other type is nonpriced such as water or visual quality for which there is no available market transactions evidence to establish a monetary value. Both priced and nonpriced outputs are considered in the formulation of Alternatives.

Alternatives must be developed within the framework of the Forest's capability and supply potentials. The supply potential for important priced and nonpriced outputs are displayed later in the Chapter in Table II-3c.

By managing the Forest lands and resources in different ways, varied objectives can be achieved which respond to different issues, thus providing different combinations of public benefits. Forest management can vary by what is done, where it is done, and when it is done. These varying combinations of management activities, management areas, and schedules will result in different resource outputs and environmental conditions, thus meeting the unique goals of the alternatives.

The Deschutes National Forest used the following steps to begin formulating its alternatives.

Public Issues and Management Concerns

Issues and concerns were used to develop a general theme for each alternative. They reflected a broad spectrum of concerns, not just isolated local issues. Included also were concerns from adjacent National Forests, State and Federal Government Agencies, and the Confederated Tribes of the Warm Springs Reservation. The Forest Service grouped them into categories that represented differing viewpoints about how the Forest could be managed. Most reflected timber, recreation and scenic quality, and wildlife-related questions.

Analysis of the Management Situation (AMS)

Information developed during the AMS step was used to help define the goals of the alternatives.

An important part of this step was the analysis of benchmarks which were used to:

Define the maximum potentials of the Forest to produce both economic benefits and resource output levels for market and non-market goods.

Evaluate the complementary and conflicting production relationships (tradeoffs) between pertinent market and non-market goods which the Forest can provide to the public.

Analyze the relative efficiencies and implications of constraints used to meet legal, policy, and discretionary resource management requirements.

Identify the range within which alternatives can be developed.

Help analyze the implications of continuing on with Current Management Direction, and if necessary to identify a need to change.

Upon completion of the AMS, it was established that there were several areas that needed new or different direction. The major points follow:

Integration of existing resource plans was inadequate.

Current Direction was not effectively treating the mountain pine beetle situation in the lodgepole pine.

Current Direction did not provide for the long-term needs of bald eagles or spotted owls.

Recreation use projections showed a need to shift some emphasis from visual to recreation management.

Long-term management direction needs to be established for roadless areas.

A long-term program for firewood needs to be established.

Development of Objectives for the Alternatives

Once the alternative themes and resource capabilities were established, objectives for the alternatives were developed to define compatible resource uses (or mixes). The objectives were expressed in one of two ways: (1) as relative levels, such as "high levels of timber" or (2) as quantities, such as "snags to meet 60 percent of the potential population level for cavity- dependent wildlife species." When relative "levels" were used, the exact outputs such as cubic feet of timber or number of recreation visitor days of developed recreation were not predetermined. The intent was to produce output levels at higher or lower rates than under Current Management Direction. When formulating alternatives where the objective was "high levels" of some goods or services, those prescriptions which emphasized the particular output were applied to as many acres as possible while meeting other objectives for the alternative.

Land Use Patterns

Constants Throughout All Alternatives

Because of Legislative or Administrative requirements, some areas of the Forest were basically "fixed". Changing these situations through Forest planning was not within our authority. Thus, one formulation criterion required that these areas be carried as constants in all alternatives. Although the locations of these areas could not be changed, in some cases existing management direction was changed (e.g., the Oregon Cascade Recreation Area and the Bend Municipal Watershed). Affected areas included Wilderness, two Research Natural Areas, one Experimental Forest and the Bend Municipal Watershed and account for 241,697 acres of the total 1,620,412 acres on the Forest. The Bend Municipal Watershed was held as a constant because of an agreement between the Secretary of Agriculture and the City of Bend. There is also little variation in habitat provided for bald eagle and northern spotted owls. This is because of the interim recovery plan for bald eagles and the minimum management requirements for spotted owls. There is only limited spotted owl habitat present on the Deschutes Forest. Roadless areas were not considered for Wilderness under any alternative.

Mapping

The Forest was mapped to determine the capability of geographic areas to produce desired conditions. The feasibility of attempting to produce those conditions in those geographic areas was also verified. This ensured that management direction was appropriate and could actually be achieved.

Prescriptions

Prescriptions were developed for each management emphasis. Each prescription emphasized a particular resource but not necessarily to the exclusion of others. All prescriptions meet all minimum resource standards. Each of these prescriptions was available for use in alternatives where the area was capable of producing the desired conditions. Then alternatives were developed by selecting from among the numerous available prescriptions.

During this process a determination had to be made about whether even-aged or uneven-aged management would be used. For the most part, the principles of even-aged management were used where prescriptions emphasized wood production. The principles of uneven-aged management were applied when emphasizing prescriptions associated with wildlife, visual quality, and recreation. See Appendix I for more details.

FORPLAN and a Description of the Analysis Process

Forest Planning is a very complex process in which an enormous amount of information and interdependent decisions must be considered before an alternative management plan can be recommended as the one which best addresses the issues, concerns, and opportunities (ICO's) which were identified at the outset of the planning problem. Because of this, several inter-related computer models and analytical tools have been developed and utilized to help determine the decision space within which alternatives can be developed and to evaluate their associated outputs and effects. Appendix B of this DEIS describes the entire analysis process in detail. Readers are encouraged to refer to that Appendix for technical information not presented in the more general overview presented in this Chapter.

As directed in the Planning Regulations (36 CFR 219.12(f)(8)):

> "Each alternative shall represent to the extent practicable the most cost efficient combination of management prescriptions examined that can meet the objectives established in the alternative."

The Planning Team, in an interdisciplinary manner, analyzed economic efficiency at several stages of the planning process in order to be reasonably ensured that the alternatives developed and displayed in the DEIS complied with the intent of this direction. The analytical process and tools used to accomplish this objective will be discussed here according to the following general outline:

1) Analysis prior to FORPLAN
2) How FORPLAN was used in the analysis
3) Any analysis done in addition to FORPLAN

Once the issues, concerns, and opportunities were identified, and the planning criteria were developed, the Interdisciplinary Team began to formulate management areas and their associated standards and guidelines. This step was probably one of the most difficult and laborious, and possibly the most important, task of the interdisciplinary planning process. Management areas coupled with their respective standards and guidelines provide specific direction for implementation, and serve as a framework for how to use, develop, and protect the Forest's resources in a manner consistent with the goals and objectives of the Plan.

Concurrently with the formulation of management areas and the standards and guidelines, the Interdisciplinary Team also began to construct its FORPLAN model. FORPLAN is an acronym for Forest Planning Model. It is a large and complex computerized linear programming model. FORPLAN is used to determine the optimal solution to a problem specified by an objective function (i.e., maximize present net value or maximize the production of timber) and bounded by resource management opportunities and limitations. Within the limits of the FORPLAN computer software, the user is allowed a great deal of latitude in formulating the mathematical representation of the Forest planning problem to be analyzed. The Deschutes FORPLAN Model was specifically designed to help the Interdisciplinary Planning Team analyze the economic and production tradeoffs associated with the recreation, timber, visual, and wildlife resources, and to help evaluate the extent to which various alternative management scenarios were able to address and resolve the identified planning issues.

One key step in the development of the FORPLAN Model was to divide the total Forest into "analysis areas". Analysis areas are tracts of land with relatively homogeneous characteristics in terms of the outputs and effects that are being analyzed in the FORPLAN Model. Their delineations were intended to capture the significant social, biological, and economic differences in the way the land responds to alternative management strategies. For this task, the R2MAP computerized grid mapping system and the Total Resource Inventory (TRI) Systems 2000 (S2K) Forest data base were used extensively to analyze different analysis area combinations that could be used to model and evaluate the production and economic tradeoffs between the recreation, timber, visual, and wildlife resources on the Forest.

In the FORPLAN model, analysis areas were allocated to management emphases in order to achieve the resource management objectives of a particular benchmark or alternative. "Management emphasis" is a FORPLAN term and is directly related to the 16 "management areas" which are described later in this chapter. Each management area contains a set of standards and guidelines concerning how the resources within that allocation are to be managed in order to meet the multiple use objectives of that management area. From one to eight different management emphases were available to each analysis area depending upon its resource production opportunities.

Once the final analysis area delineation was settled upon, the next step was to develop the prescriptions for the FORPLAN model. In FORPLAN, prescriptions are identified in terms of combinations of management emphases and intensities. Prescriptions serve as the basis for choice of what can be done on a specific analysis area. They are combinations of scheduled activities and practices, and their associated outputs and effects. The management prescriptions and their range of timing choices are represented as decision variables in FORPLAN. The outputs and effects associated with the prescription choices are represented as numerical coefficients in the respective decision variables. FORPLAN had from one to six prescriptions to choose from for each management emphasis for each analysis area. In general, each analysis area contained from 1 to 21 prescription choices. The average was over 13.

The process of developing FORPLAN prescriptions included the development of timber yield tables, other resource yield coefficients, and the economic costs and benefits associated with each FORPLAN prescription. These prescriptions were designed to enable FORPLAN to analyze the production and economic tradeoffs between the recreation, timber, visual, and wildlife resources on the Forest. The model was utilized to analyze the most economically efficient timber-related outputs and effects associated with the achievement of the multiple use objectives of an alternative.

Which prescriptions FORPLAN selected depended upon the objective function and the set of constraints used to represent a particular benchmark or land management plan alternative. The objective function was usually to maximize present net value or maximize the production of timber. These were subject to first satisfying all the specified constraints. The constraints were designed to guarantee the spatial and temporal feasibility of land allocation and harvest scheduling choices in order to achieve the multiple use objectives of a benchmark or alternative. The following is a list of some of the types of constraints used:

1) constraints on harvest flow, rotation length, and ending inventory;

2) dispersion and wildlife minimum management requirement constraints;

3) constraints on the amount of analysis areas available to certain management area prescription sets;

4) rate of harvest constraints in scenic view and intensive recreation allocations;

5) constraints for thermal cover in deer winter range allocations; and

6) other miscellaneous constraints such as accelerated lodgepole pine harvesting, species mix, and budget levels.

Once the model had determined that a feasible solution existed by satisfying all of the constraints, it would then search for the set of prescriptions and timing choices which permitted it to optimize the solution according to the specified objective function.

Several other steps in the analysis process were implemented before the evaluation of a benchmark or alternative were considered complete. The outputs and effects associated with the recreation and range programs for the respective benchmark or alternative were analyzed outside of FORPLAN with the use of electronic spreadsheets. During this step, alternative capital investment, and operations and maintenance strategies were examined to determine which resulted in the most efficient prescriptions to meet the objectives of the particular benchmark or alternative.

Another step in the analysis process consisted of loading the FORPLAN solution onto the transportation network model (Transship) in order to determine the most cost efficient capital investment, and operations and maintenance program, and the associated transportation system needed to move the projected timber and recreation traffic around the Forest.

Next, an electronic spreadsheet was used to determine the total forest budget that would be required to implement each alternative or benchmark. The budget estimates were based on the various resource output levels, capital investment, and operation and maintenance programs that were developed in the previous analysis steps. The budget levels were tracked by resource, appropriated versus allocated funds, and capital investment versus operations and maintenance costs.

Finally, all market plus assigned priced benefits associated with the timber, recreation, range, and special use outputs, and the associated forest budget for the first five decades were entered into a spreadsheet which calculated the total present net value of the particular benchmark or alternative being evaluated. Even though a Plan is for 10-15 years, five decades were used to have a meaningful way of calculating present net value.

Which land allocation and resource management investment options resulted in the most economically efficient solution was determined through iterative model and spreadsheet analyses. For example, the Maximum Present Net Value (PNV) Benchmark (market plus assigned values) was arrived at by first examining the solution to the Maximum PNV Benchmark (market values only) and adding the associated recreation and range present net values to it. A per acre PNV analysis indicated that the total Forest PNV could be increased by allocating intensive recreation management areas in the FORPLAN model. These allocations resulted in higher combined timber and recreation discounted values than if they had been managed for timber alone. The other recreation allocations excluded the harvesting of timber and their discounted values were less than if they had been allocated to timber production. FORPLAN was run again with the appropriate intensive recreation allocations added in and the resulting timber PNV was added to the PNV for the recreation and range resources to arrive at the maximum present net value (market plus assigned) for the Forest.

The other Benchmarks were analyzed with FORPLAN through combinations of different objective functions (maximize timber or maximize present net value) and constraints on harvest flow, rotation length, minimum management requirements (MMR's), and discretionary constraints needed to achieve the respective multiple resource objectives. Again, the FORPLAN analyses were augmented with spreadsheet analyses of the recreation, range, and forest budget outputs and effects.

Once the Benchmark analyses were completed, the Interdisciplinary Team proceeded to evaluate the range of alternatives that were developed to address the issues, concerns, and opportunities. Each issue, concern and opportunity was addressed in the alternatives either through land allocations, harvest scheduling, standards and guidelines, or policy statements. Alternatives were modeled through the specification of an objective function and a set of constraints that were necessary to achieve the intent of a particular alternative.

The economic analysis of each alternative with FORPLAN, Transship, and the various spreadsheets was followed up by several other analytical steps before the evaluation of an alternative was considered complete. Three of these additional analytical tools were software programs developed by the Interdisciplinary Team to generate custom reports from the FORPLAN solution. One converted the cubic foot harvest schedule from FORPLAN to board feet by working group and diameter class for five decades. This was used to facilitate communications both internally and externally with people who understand boards better than cubes. Another program interpreted the dynamics of the FORPLAN forest inventory in terms of the seven successional stages by working group for fifteen decades. This better enabled the wildlife biologists to evaluate the effects of the harvest schedule solution on the habitat requirements of certain key indicator species. A third program disaggregated the FORPLAN solution to each of 86 implementation units. Implementation units are contiguous areas of land averaging 19,000 acres in size and are combinations of up to three TRI database compartments. This made it much easier for personnel on the Ranger Districts to understand the implications of each alternative in terms of where, when, and how they were to implement the alternative if it were selected as the Preferred. This also provided a forum for verifying the spatial feasibility of an alternative.

Sometimes the results from any one of these additional analyses indicated the need to do more FORPLAN runs in order to improve upon the overall evaluation of the outputs and effects of a particular alternative. Sometimes the need was apparent to develop another alternative and proceed through the analysis process with it. Once the Team was satisfied with the outputs and effects of the alternatives, their implications with regard to income and jobs in the local economy were analyzed with the IMPLAN input/output model. After all of this was done to satisfaction, the Interdisciplinary Team along with the Forest Management Team and District personnel evaluated how well each alternative addressed the issues, concerns, and opportunities that were identified at the outset of the planning process. Based on this analysis, a Preferred Alternative was recommended to the Regional Forester.

Role and Use of Benchmarks

The first steps involved the creation of "benchmarks" and the inspection of their outputs, costs, and assumptions. Benchmarks are similar to alternatives in that they are a combination of land capability, management practices, and schedules to achieve certain objectives. But unlike alternatives, they usually could not actually be implemented because they lack a consideration of likely budgets, specific geographic locations, environmental effects, compliance with management regulations, legal requirements, and other factors. They do provide significant information about the maximum biological and economic production opportunities. They assist in evaluating the compatibilities and conflicts between market and nonmarket objectives, and they define the range within which integrated alternatives will be developed.

Some benchmarks are economically based, while others indicate the maximum physical productivity of land for various resources. In these benchmark analyses, each option must include meeting minimum management requirements of 36 CFR 219.27, such as protecting the productivity of the land and meeting minimum air and water quality standards. Benchmarks are described further in Appendix B.

Objectives of the Benchmarks

Several benchmarks are required by the Regulations [36 CFR 219.12(e)] and National direction. They include:

- Minimum Level: This benchmark specifies the minimum level of management which would be needed to maintain the Deschutes National Forest as part of the National Forest System.
- Maximum Present Net Value Based on Established Market Price: This benchmark specifies the management of the Deschutes National Forest which will maximize the present net value of those outputs that have an established market price.
- Maximum Present Net Value Including Assigned Values: This benchmark specifies the management which will maximize the present net value of those outputs that have either an established market price or assigned monetary value.
- Current Level: This benchmark specifies the management of the National Forest most likely to be implemented in the future if current direction is followed. This benchmark forms the basis for the "no action" alternative.
- Maximum Resource Levels: Each of these benchmarks estimates the maximum capabilities of the Forest to provide a single resource emphasis level.

  Timber
  Range
  Wilderness

Other benchmark analysis is conducted to determine the effect of various minimum management requirements, discretionary constraints, and the effect of restricting timber harvest rotations to the culmination of mean annual increment (CMAI) and of nondeclining flow (NDF) of timber harvest.

If a benchmark appeared to offer a viable opportunity to respond to issues, concerns, and opportunities, further analysis is conducted to examine it as a potential alternative. Thus some benchmarks are the basis for alternatives. Others display too many environmental, fiscal, legal, and practical problems in the analysis and are eliminated from detailed study.

Required Alternatives

By inspecting the information generated by the benchmark analysis, and the analytic limits and reference points identified by the various benchmarks, the Interdisciplinary Team proceeded with constructing alternatives which could be implemented on the Forest. Among the alternatives were several that were required by the Regulations and National and Regional direction. The required alternatives are listed and briefly described here.

- **Current Direction (No Action):** This is the alternative of "No-Action" required by the Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14). This alternative would (1) continue the management of the Deschutes National Forest as defined by existing direction in approved management plans; (2) continue existing policies, standards, and guidelines; (3) update the current budget to reflect changing costs over time; and, (4) to the extent possible, produce current levels and mixes of resource outputs.

  Alternative A is the Current Direction Alternative (or the "No-Action" Alternative) in this DEIS.

- **Emphasis on the Current RPA Program:** This alternative will determine how the Current (1980) RPA Program distributed to the Forests through the Regional Guide can best be implemented.

  Alternative B is the current RPA program alternative in this DEIS.

- **Emphasis on Market Opportunities:** This alternative has an emphasis on outputs that have an established market price (timber, forage, commercial fish, developed recreation opportunities, and minerals). Management for other resources will be at economically and environmentally feasible levels consistent with the emphasis on market-oriented outputs.

  Alternative C is the alternative in this DEIS which emphasizes market opportunities for the Deschutes National Forest.

- **Emphasis on Nonmarket Opportunities:** This alternative puts an emphasis on water, fish and wildife, recreation, and other amenity values. Management for other resources will be at economically and environmentally feasible levels consistent with the emphasis on amenity values.

  Alternative G is the alternative in this DEIS which emphasizes nonmarket opportunities.

- **Emphasis on nondevelopment and intensified management:** This alternative incorporates a large portion of the roadless areas on the Forest as undeveloped while increasing commodity production on those areas already roaded. Its purpose is to balance the economic effects of not beginning commodity production in roadless areas.

Alternative H is the alternative which best emphasizes nondevelopment and intensified management in this DEIS.

Departure Alternatives

Alternatives B, C, E, and H are "Departure" Alternatives. Departure means that the amount of wood sold in any decade is less than the amount of wood sold in the previous decade as opposed to nondeclining yield which means that the wood sold in any decade is equal to or greater than the wood sold in the previous decade. The alternatives were developed by determining land use patterns and resource management prescriptions which applied. A nondeclining yield timber schedule was then developed for each departure Alternative. Numerous iterations were made on the structure of departure before a final schedule was developed. In many cases management under these alternatives would raise the volume of harvested timber in the near future, but lower the volume of timber available in the intermediate future.

Other Alternatives

Additional alternatives, including those necessary to respond to the full range of public issues, management concerns, and resource use and development oportunities, were formulated to reflect a broad range of resource outputs and expenditure levels. Additional alternatives respond to 36 CFR 219.12(f)(1) which requires alternatives to "be distributed between the minimum resource potential and the maximum resource potential" to display the "full range" that a Forest could produce.

The Preferred Alternative

The Preferred Alternative (Alternative E) has been identified. The selection of the Preferred Alternative was made only after careful comparison of all the alternatives on the basis of their resource outputs, environmental effects, implementation costs, and the "trade-offs" between them. The Preferred Alternative is that alternative which was selected from all those formulated as the one which best maximized the net public benefits in an environmentally sound manner. After the Forest Supervisor reviewed the Interdisciplinary Team's evaluation, and after the

Regional Forester and his staff had reviewed the alternatives, this alternative was selected as the Preferred Alternative in this draft EIS.

Alternative E is the Preferred Alternative.

Alternatives Considered, But Eliminated From Detailed Study

Three Alternatives were developed, but dropped from further study.

1. One Alternative was developed to examine extensive management and minimum agency regulation and control. The land-use pattern would have emphasized providing maximum opportunities to harvest forest products.

   It was dropped from further analysis because:

   (a)It did not address clear or specific issues and reflected the concerns of a small, undefined segment of the public.

   (b)It emphasized types of custodial management which are not consistent with the current need for active land management.

   (c)Low investment rates did not recognize opportunities for increases in outputs nor did they recognize capital investments already incurred.

2. A second Alternative, which was presented as Alternative D in the Draft EIS released for public comment in November 1982, was dropped. It was very similar to two other Alternatives and received little public comment, was not responsive to some issues, and was determined not to be needed to have an adequate range of Alternatives. The outputs and environmental effects were very similar to those of other Alternatives.

   The difference between D and others was a slight variation on how sensitive areas were managed. These variations did not prove useful in evaluating the public's sensitivity to these areas.

3. The third Alternative which was dropped from further consideration was a variation from Alternative G presented in this DEIS. For this Alternative, all forested lands with negative soil expectation values (negative present net values of managed stands starting with bare ground) were excluded from the suitable and available forested land base for harvest scheduling purposes. In the original Alternative G, 804.1 thousand acres of forested land were determined to be suitable and available for timber harvesting. Using this acreage base, the long-term sustained yield was calculated to be 32.5 MMCF per year. Using the per acre negative soil expectation values to screen economically undesirable acres from being considered for harvest scheduling, the suitable and available land base was decreased by 9.4 thousand acres to 794.7 thousand acres. The resulting long-term sustained yield and allowable sale quantity were estimated to be 32.1 MMCF per year, a drop of about 1.2 percent from the original harvest levels calculated for Alternative G. Since this approach for determining the economic suitablity of forested lands is not consistent with current policy, this Alternative was not developed in detail.

The benchmarks are not feasible to implement, because they lack budgets and land use decisions, so were not fully developed and evaluated as Alternatives.

Alternatives Considered in Detail

Description of the Alternatives

Introduction

The alternatives considered in detail demonstrate different ways of managing the land and resources of the Deschutes National Forest for the next 10-15 years. Each is a combination of land uses, management practices, and activity schedules which results in a unique combination of resource outputs, land uses, and environmental conditions. Throughout Chapter II, the tables and text display or discuss information for five decades. A Plan implementing any of the alternatives would be for 10-15 years. The information for decades 2 through 5 is to demonstrate the potential outputs and effects if the alternative were carried beyond the first 10-15 years.

Together these alternatives present a broad range of reasonable management alternatives. They were formulated through an analysis process that explored a wide array of possibilities shown in the benchmarks and in the required alternatives.

Each alternative distributes the lands of the Forest to different management areas. Acreages in the different management areas vary from one alternative to another. (See Table II-2.) A description of the management areas and the goals of land and resource management in them are presented later in this chapter in the discussion preceeding Table II-2. Locations of the management areas for each alternative are shown on the maps which accompany this DEIS.

The management areas are subject to management according to specified standards and guidelines. These ensure that potentially adverse environmental effects are mitigated through avoiding, minimizing, rectifiying, or reducing them (or in some cases by compensating for them). Some of these standards and guidelines were developed to respond to environmental conditions on the Deschutes National Forest. Others are adopted from the Regional Guide. They are presented or referenced in Appendix D of this DEIS. Standards and guidelines which apply to the Preferred Alternative are found in the Proposed Forest Plan, which accompanies this DEIS.

Managing the Forest according to the different alternatives will result in various land uses, resource outputs, and environmental effects. Some differences among alternatives represent the specific objectives of the alternative. All of the significant land uses, environmental effects, and resource outputs are presented by alternative and by time period in Tables II-3a and Table II-3b. Table II-3a presents those uses, effects, and outputs which are quantified; Table II-3b, those which are qualitative.

All of the timber related outputs in the Alternatives are based on the assumption that pesticides will be available for use even though use of pesticides on the Forest is limited. In June 1981, the Pacific Northwest Region of the USDA Forest Service issued a Programmatic Final Environmental Impact Statement (FEIS) for Methods of Managing Competing Vegetation, which included detailed discussions and analysis of a preferred alternative (full use of all methods). Use of chemicals was critically examined. Alternatives to the preferred (including no vegetation management, and no application of herbicides) and the consequences of these alternatives on the environment were documented. Based on the preferred alternative in the Methods of Managing Competing Vegetation Environmental Impact Statement (EIS), all alternatives in this Forest Plan DEIS are based on the continued use of the full range of alternative treatment methods including manual, mechanical, prescribed fire, biological, and chemical methods. The selection of any particular treatment method will be made at the project level based on a site specific analysis of the relative effectiveness, environmental effects, (including human health), and the costs of feasible alternatives. Herbicides will be selected only if their use is essential to meet management objectives. The use of pesticides would be monitored.

If current policy on the use of herbicides were to change to either disallow or restrict their use, then, based on the effects outlined in the Competing Vegetation Management EIS, the outputs in the alternatives in this DEIS for timber would decrease slightly and the costs would increase.

The causes and relationships of the resource outputs and environmental effects are discussed in Chapter IV, Environmental Consequences. The outputs and effects are also summarized there. However, the most detailed reporting of each alternative's land uses, resource outputs, and environmental conditions are here in Chapter II. In this way several types of outputs and effects of the alternatives can easily be compared at one time.

The following alternatives were selected for detailed study. They represent a broad range within the decision space defined by the benchmarks. The alternative descriptions are preceded by an illustration of how the Forest would look in the long term under that alternative.

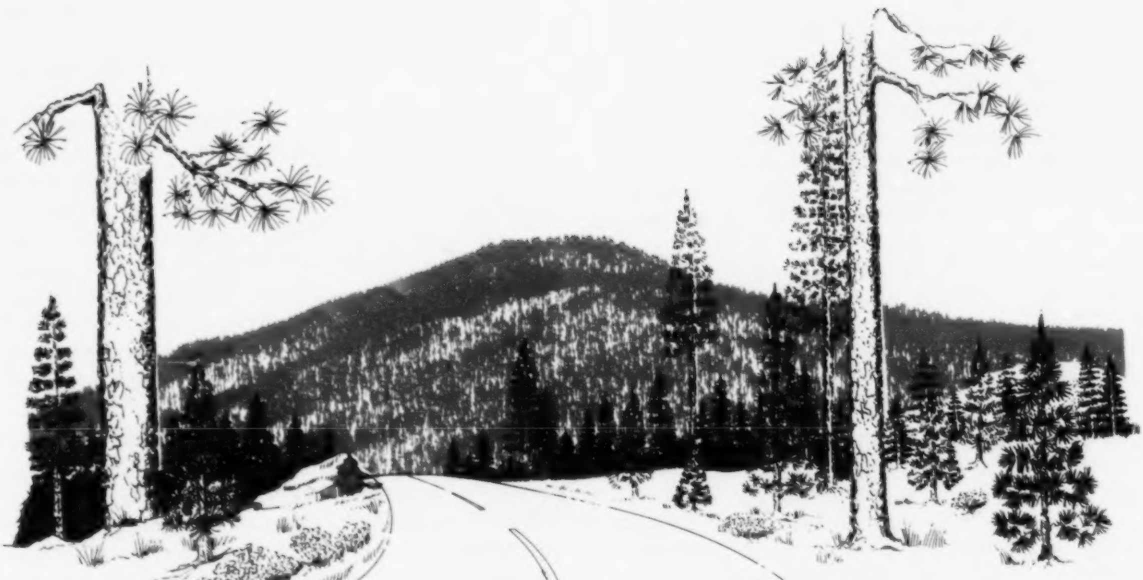


Figure I

Alternative Goals and Objectives

Alternative A (Current Direction)

The "No Action" Alternative presented below does not specifically address the identified issues and concerns. It is more a description of continuing on with current management direction, as required by NEPA.

The "No-Action" Alternative, or Current Direction under the 1978 Land Management Plan, features a blend of land uses intended to balance resource uses. Dispersed recreation, visual quality, and deer habitat management are emphasized along with timber and range management. Some emphasis is placed on developed recreation, old growth, and threatened and endangered species.

Vegetation

Trees

Trees will be managed to provide cover for big game, habitat for bald eagles, to meet recreation and visual quality objectives, and to produce wood fiber and firewood. Timber would be harvested on both a chargeable (fixed amount on an annual basis) and nonchargeable (not a fixed amount but can vary depending on the need to manipulate a stand to meet some objective) basis.

Timber harvesting is scheduled on a nondeclining yield basis. The current annual allowable harvest is about 190 million board feet (39.6 MMCF) of chargeable and 15 to 20 million board feet (3.2 MMCF) of nonchargeable timber. Mature and overmature lodgepole pine is scheduled to be converted to managed stands in 20 years if the alternative is continued beyond the 10 to 15 year life of a Plan.

Range

Full use of forage available to livestock is emphasized. Cost effective management systems and techniques, including fencing and water development, are designed and applied (1) to obtain relatively uniform livestock distribution and use of forage and (2) to maintain plant vigor.

Recreation

Developed Recreation

All campgrounds where a fee is charged will receive a Full Service Level of cleaning and maintenance. Nonfee campgrounds will receive Reduced Service Level or a minimum standard of cleaning and maintenance. Day use sites, other than those associated with fee campgrounds, will be managed at a reduced service level (RSL). Very few sites will be closed.

Some new campgrounds and day use facilities such as picnic areas and boat launch sites will be built but this will not meet the projected demand. Some sites may be built and operated by private developers.

Dispersed Recreation

Forty-five percent of the unroaded lands will have an undeveloped prescription and the majority of the unroaded lands should remain undeveloped at the end of the second decade based on the timber harvest schedule.

The summer trail system for horses and hikers will be maintained at the current level. Missing sections will be constructed and substandard sections will be reconstructed. A mountain bicycle trail system will be developed. Trails for motorcycles and all terrain vehicles (ATV's) will also be developed. Most of the Forest's low standard roads (those not maintained for passenger cars) will be open to off-road vehicles.

For winter recreation the existing nordic and snowmobile trail system will be maintained and expanded. Snow parks will be constructed to meet increases in demand.

Oregon Cascade Recreation Area (OCRA)

In the OCRA all existing roads would remain open to motorized use and be maintained at their current standards. Wildlife and fish habitat could be improved in the Big Marsh and Little Deschutes drainages. Dead and dying trees could be salvaged where roads exist. All trails would be open to motorized vehicles and the remainder of the area would be closed. Over the snow vehicles will be permitted in the winter.

Visual Resources

All State, County, and most major Forest Service roads are protected. The same is true for all major buttes and many of the minor or less prominent buttes.

It is important to review the alternatives map to identify the difference between alternatives.

Wild and Scenic Rivers

No rivers have been recommended for classification under the Wild and Scenic Rivers Act. Development of low-head hydropower facilities on the Deschutes River is not addressed specifically.

Special Areas

Newberry Crater is currently designated as a National Natural Landmark under the Historic Sites Act of 1935.

Some Special Interest Areas have been established and others were recommended for designation; but no action has been taken on them. The existing and proposed areas are listed below.

Name	Status
Lava Butte	Existing
Lava Cast Forest	Existing
Lavacicle Cave	Existing
Katati Butte	Proposed
Big Hole	Proposed
Hole-in-the-Ground	Proposed
Newberry Crater	Proposed
Castle Rocks	Proposed
Balancing Rocks	Proposed
Horn-of-the-Metolius	Proposed
Wake Butte	Proposed

Wildlife Habitat

Big Game Habitat

Ninety-three percent of the important deer habitat is allocated to the Game Species Management Option. Habitat improvement is limited due to low funding levels. The current mule deer population is 20,300.

Other Wildlife

Habitat for cavity dwelling species would provide for 60 percent of the maximum potential populations in ponderosa pine and mixed conifer and 40 percent in lodgepole pine.

Old Growth

Three percent of the ponderosa pine, lodgepole pine, mixed conifer, and mountain hemlock timber types are retained in old growth. This, combined with other areas which result in old growth because trees are not scheduled for timber harvesting, leaves 13 percent of the Forest in old growth.

Energy

Geothermal

No action was taken on leasing in the Newberry Crater Known Geothermal Resource Area. Leasing decisions on the remainder of the Forest have been addressed by Environmental Assessments keyed to the 1978 Land Management Plan. No leasing is allowed in Wilderness Areas.

Firewood

Personal use firewood is available on a permit basis. No upper or lower limits on the total amount of firewood devoted to personal use have been established. The estimated amount of firewood used for personal use is 60,000 cords.

Research Natural Areas

There are two Research Natural Areas -- one at Pringle Falls and the other near the Metolius River.

Transportation

Specific issues and concerns are associated with Todd Lake-Three Creeks Lake road, the Irish- Taylor road, the road to Waldo Lake and the road over Windigo Pass. They are being maintained in their current condition.

Roadless Areas

The following display indicates the proposal for each roadless area. For more details refer to Table II-3d and/or Appendix C.

Roadless Area	Developed	Partly Developed	Undeveloped
Mt. Jefferson	X		
Metolius Breaks		X	
Three Sisters		X	
West/South Bachelor		X	
Bearwallows		X	
Bend Watershed		X	
Waldo		X	
Charlton			X
North Paulina	X		
South Paulina	X		
Maiden Peak		X	

SUMMARY OF RESULTS RELATED TO KEY ISSUES - ALT. A

ISSUE	RESULT
Timber	
Million cubic feet average annual allowable sale quantity (ASQ) for the first decade	39.6
Million board feet average annual ASQ for the first decade	190
Recreation	
Average annual MRVD's of developed recreation.	1837
Average annual MRVD's of dispersed recreation.	2036
Planned Campground Construction	Some
Wildlife	
Potential mule deer population.	20,300
Potential bald eagle population (Pairs)	20
Potential osprey population (Pairs)	180
Energy	
M Acres of high potential geothermal areas available for leasing.	102.9
Amount of personal use firewood provided.	No Specific Amount
Social/Economic	
Present net value	$ 741.31 Million
First decade average revenues to the government.	$ 28.8 Million
First decade average annual returns to the counties.	$ 7.2 Million

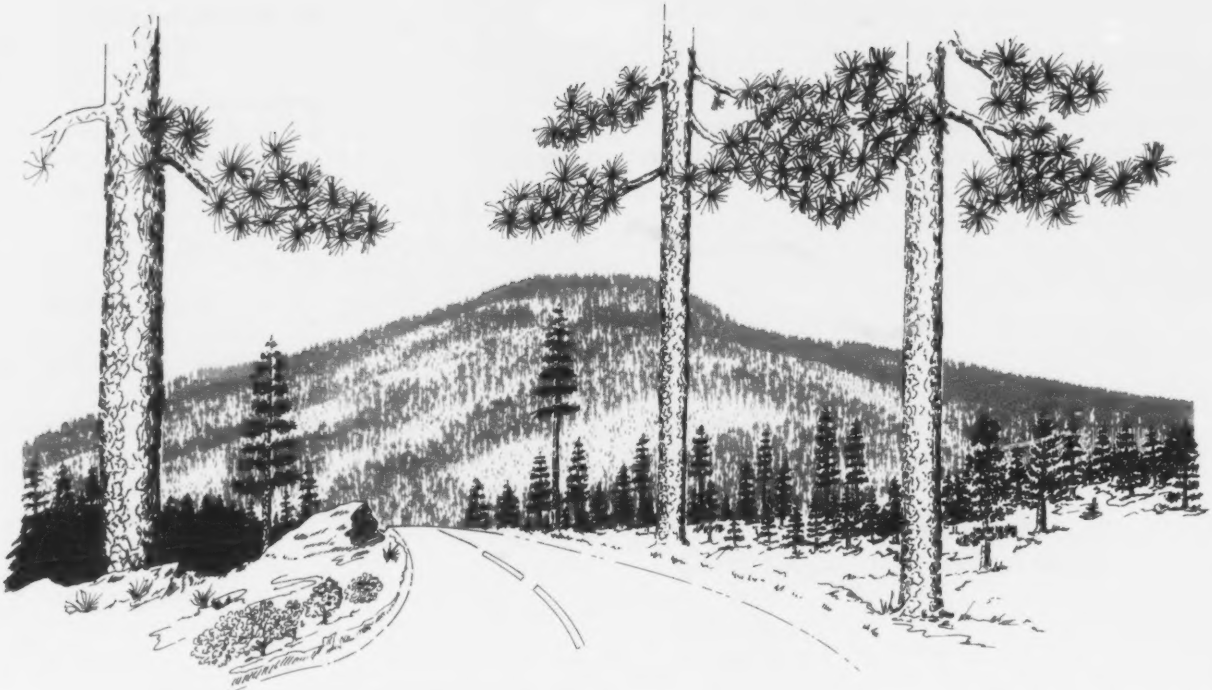


Figure II

Alternative B—RPA

The goal of this Alternative is to meet the 1980 RPA program as identified for the Deschutes National Forest in the Regional Guide. It is similiar to Alternative F but has a different mix of prescriptions on specific areas within the Forest.

You will need to refer to the maps of the Alternatives to fully understand the differences between Alternatives B, E, and F.

Alternative B provides moderate levels of resource outputs. The Forest would be intensively used and developed, but options for maintaining undeveloped lands and old-growth ecosystems would be retained.

A mix of developed and undeveloped recreation opportunities would be provided. This Alternative would provide for increases in deer and bald eagle populations. Some of the higher potential geothermal areas would be available for leasing.

Scenic quality would be emphasized along heavily used roads, developed recreation areas, and some roads to trailheads.

Vegetation

Trees

Trees will be managed to provide cover for big game and habitat for bald eagles, to meet recreation and visual quality objectives and to produce wood fiber and firewood. Timber would be harvested on both a chargeable (a fixed amount on an annual basis) and nonchargeable (not a fixed amount but can vary depending on the need to manipulate a stand to meet some objective) basis. Areas managed with a recreation emphasis would be nonchargeable.

The timber harvest levels would be based on a departure from nondeclining yield in order to meet the RPA timber targets. In the long term, the decline in wood output begins in the sixth decade and proceeds down until the eigth decade at which time it begins to increase again. For the first decade (or 10-15 year life of a Plan) the annual harvest level is 46.7 million cubic feet or 196 million board feet.

Generally mature and overmature lodgepole pine would be converted to managed stands in 10 to 15 years. The stands would be converted in 20 years in areas managed for scenic quality.

Of the lands that are available for timber production, 95 percent of them are used in the development of the timber program.

During the first decade, 56 percent of the cubic foot volume is from lodgepole pine stands and 37 percent is from ponderosa pine stands. In the second decade this shifts to 39 percent lodgepole and 21 percent ponderosa pine. Mixed conifer species make up 7 percent of the volume in the first decade and 41 percent in the second.

During the first decade, 62 percent of the harvesting is clearcuts and shelterwoods. Approximately 15,100 acres would be reforested annually.

Range

Use of vacant grazing allotments would be encouraged. Full use of forage available for livestock would be emphasized. Range investments would be increased above current levels. Cost effective management systems and techniques, including fencing and water development, would be designed and applied (1) to obtain relatively uniform livestock distribution and use of forage and (2) to maintain plant vigor.

Recreation

Developed Recreation

All campgrounds where a fee is charged will receive a Full Service Level (FSL) of cleaning and maintenance. Nonfee campgrounds will receive Reduced Service Level (RSL) or a minimum standard of cleaning and maintenance. Day use sites, other than those associated with fee campgrounds, will be managed at RSL. Very few sites will be closed.

New campgrounds and day use facilities such as picnic areas and boat launch sites will be built to meet the projected demand. Some sites may be built and operated by private developers.

Dispersed Recreation

Forty-one percent of the unroaded lands will have an undeveloped prescription and 88 percent of the undeveloped lands could remain undeveloped at the end of the second decade based on the timber harvest schedule. However, roads may be developed in some areas to treat the mountain pine beetle epidemic and for geothermal exploration.

The summer trail system for horses and hikers will be maintained at the current level. Missing sections will be constructed and substandard sections will be reconstructed. A mountain bicycle trail system will be developed. Trails for motorcycles and all terrain vehicles (ATV's) will also be developed. Most of the Forest's low standard roads (those not maintained for passenger cars) will be open to off-road vehicles.

For winter recreation the existing nordic and nordic and snowmobile trail system will be maintained and expanded. Snow parks will be constructed to meet increases in demand.

Oregon Cascade Recreation Area (OCRA)

In the OCRA all existing roads would remain open to motorized use and be maintained at their current standards. Wildlife and fish habitat could be improved in the Big Marsh and Little Deschutes drainages. Dead and dying trees could be salvaged where roads exist. All trails would be open to motorized vehicles and the remainder of the area would be closed, except for over the snow vehicles.

Visual Resources

All State and County highways and many Forest Service roads including those to major trailheads, are protected. Most major buttes are also protected, but only part of the areas seen west of Davis Lake are protected. The area south of Mt. Bachelor and most of Pine Mountain are also protected.

It is important to review the alternative maps to identify the major differences between Alternatives B, E, and F.

Wild and Scenic Rivers

To ensure a broader range of recreation opportunities, the source of the Metolius River to Bridge 99 and the source of the Deschutes River to the north Forest boundary would be recommended for inclusion in the Wild and Scenic Rivers system as Recreation Rivers. Low-head hydropower facilities would not be compatible on river sections recommended for classification.

Special Areas

Additional Special Interest Areas would be included because of unusual geological or botanical values. They are listed below:

Name	Status
Lava Butte	Existing
Lava Cast Forest	Existing
Lavacicle Cave	Existing
Wake Butte	Proposed
Castle Rock	Proposed
Katati Butte	Proposed
Hole in the Ground	Proposed
Big Hole	Proposed
Balancing Rock	Proposed
Moffit Butte	Proposed
Lava River Cave	Proposed
Davis Lake	Proposed

Wildlife Habitat

Big Game Habitat

Thirty to 50 percent of the important deer habitat would be maintained in thermal cover. Approximately 25 percent of the shrub communities would be regenerated to younger shrub classes by prescribed burns each decade. The amount and condition of habitat could increase the mule deer population to 28,600 animals.

Other Wildlife Habitat

Habitat for cavity dwelling species would be retained at 60 percent of the maximum biological potential.

Old Growth

Old growth will be present on approximately 12 percent of the Forest. Some of this is a result of areas which are not developed or scheduled for timber harvesting. The remainder is a result of establishing 5 percent of the forested plant communities as old growth.

Energy

Geothermal

Geothermal leasing in the Newberry Crater KGRA could be permitted on the exterior of the Crater and on the southern portion in the interior of the Crater.

The remainder of the interior of the Crater would not be available for leasing.

Geothermal leasing could be allowed in a few new areas not already under lease. As a result, 34 percent of the high potential areas, 48 percent of the moderate, and 69 percent of the low would be available for leasing.

Firewood

Twenty million board feet (60,000 cords) would be made available annually for personal use firewood. By 1995, mature dead and dying lodgepole pine would comprise a large part of this wood. Beyond that, the type of material would shift to other products and species. The amount available per individual permit would be adjusted based upon demand. Should demand continue to increase, the amount per permit could be decreased. Demand could reach a point where it may be necessary to limit the number of permits issued. The price of personal use firewood would trend upward and be re-evaluated each year. Areas where personal use firewood cutting would be emphasized could also be determined on an annual basis. The trend, however, would be that cutting areas would be located further and further from Bend and LaPine as time passed. During the first 10 years, much of the emphasis would be on the Fort Rock and Crescent Districts.

Research Natural Areas

The following areas would be recommended for inclusion in the Research Natural Area program:

- Cultus River
- Cache Mountain
- Katsuk Butte
- Torrey-Charlton
- Many Lakes
- Wechee Butte
- Mokst Butte

Transportation

The Todd Lake to Three Creeks Lake road and the Irish-Taylor road would be maintained at their current standard. Forest Road 5897 (Waldo Lake road) and Windigo Pass would be improved some to allow for increased traffic.

Roadless Areas

The following display indicates the proposal for each roadless area. For more details refer to Table II-3d and/or Appendix C.

Roadless Area	Developed	Partly Developed	Undeveloped
Mt. Jefferson	X		
Metolius Breaks		X	
Three Sisters		X	
West/South Bachelor		X	
Bearwallows	X		
Bend Watershed		X	
Waldo		X	
Charlton		X	
North Paulina		X	
South Paulina	X		
Maiden Peak		X	

SUMMARY OF RESULTS RELATED TO KEY ISSUES - Alt. B

ISSUE	RESULT
Timber	
Million cubic feet average annual ASQ for the first decade.	46.7
Million board feet average annual ASQ for the first decade.	196
Recreation	
Average annual MRVD's of developed recreation.	2567
Average annual MRVD's of dispersed recreation.	2386
Planned Campground Construction	Meet demand
Wildlife	
Potential mule deer population.	28,600
Potential bald eagle population (Pairs)	45
Potential osprey population (Pairs)	80
Energy	
Thousands of acres of high potential geothermal areas available for leasing.	100.0
Amount of personal use firewood provided.	60,000 cords
Social/Economic	
Present net value	$ 1124.1 Million
First decade average revenues to the government.	$ 21.6 Million
First decade average annual returns to the counties.	$ 5.4 Million

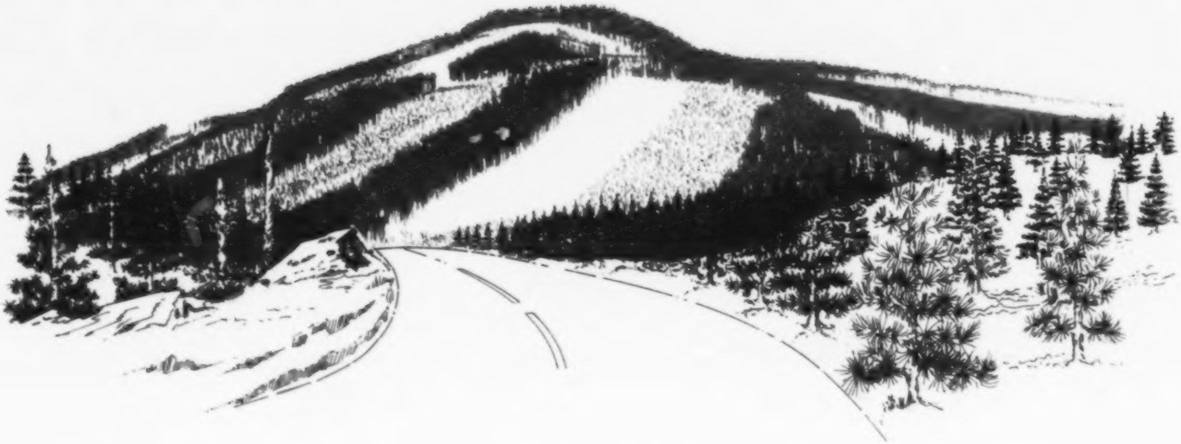


Figure III

Alternative C

The goal of this Alternative is to maximize present net value and provide increased use of commodity resources and other resources which have potential to increase contributions to the local economy.

Much of the Forest would be used for producing commercial timber. This Alternative would permit the maximum amount of geothermal leasing. Recreation management would focus on providing access and facilities for large numbers of people, such as developed recreation sites, vehicle use in the summer, downhill skiing and snowmobiling in the winter, deer hunting, and fishing. The Forest would be heavily roaded. Scenic resources would be protected or enhanced along heavily traveled roads.

Vegetation

Trees

Trees will be managed to provide cover for big game and habitat for bald eagles, to meet recreation and visual quality objectives, and to produce wood fiber and firewood. Timber would be harvested on both a chargeable (fixed amount on an annual basis) and nonchargeable (not a fixed amount but can vary depending on the need to manipulate a stand to meet some objective) basis. Lands managed with an emphasis on developed recreation would be chargeable.

From the lands available for timber production, timber harvesting is programmed on 91 percent of them. Lands not programmed are generally those with lower timber values and higher management costs.

High levels of timber would be produced. This Alternative would respond to the Forestry Program for Oregon, as defined for the Deschutes National Forest by the Oregon State Forester. It is a departure timber harvesting schedule with harvest levels that are lower in the second decade than in the first decade. This drop by decade occurs until the fourth decade at which time it levels off at 45.4 million cubic feet or 247 million board feet annually. The first decade harvest is 65.2 million cubic feet or 290 million board feet annually.

During the first decade, 45 percent of the cubic foot volume is from lodgepole pine while 31 percent is from ponderosa pine stands. In the second decade, lodgepole pine shifts to 35 percent and ponderosa pine shifts to 29 percent. Mixed conifer species comprise 24 percent of the harvest in the first decade and 35 percent in the second. Mature and overmature lodgepole pine stands would be converted to managed stands in 10 to 15 years.

During the first decade, 66 percent of the acres scheduled for harvesting will be clearcuts or shelterwood cuts and approximately 19,400 acres would be reforested annually.

Range

Forage for livestock and big game would be produced and used at maximum levels. Cost effective methods for achieving improved forage supplies would be developed and practiced. Heavy investments in range improvements such as brush disposal, fertilization, and seeding would be used to improve the quality and quantity of forage.

Recreation

Developed Recreation

All fee and nonfee campgrounds will receive the Full Service Level (FSL) of cleaning and maintenance. Day use sites associated with motorized use such as boat ramps and snowmobile parking lots will also be managed at FSL. Those day use sites associated with non motorized uses such as Wilderness trailheads will be managed at reduced service level. No campgrounds will be closed.

New campgrounds and day use facilities associated with motorized use will be built to meet the projected public demand. Some of these sites may be built and operated by private developers.

Dispersed Recreation

Four percent of the unroaded lands will have an undeveloped prescription and 70 percent of the unroaded lands could remain undeveloped at the end of the second decade based on the timber harvest schedule. However, roads may be developed in some areas to treat the mountain pine beetle epidemic and for geothermal exploration.

The nonmotorized trail system for horses, hikers, and nordic skiers will be maintained at or below the current standard. No new construction or reconstruction would be planned for this system.

The trail system for motorized use which would include motorcycles, all terrain vehicles (ATV's), and snowmobiles would be maintained at or above the current standard and this system would be expanded. Most of the low standard road systems (those not maintained for passenger cars) would be open to off-road vehicles.

Oregon Cascade Recreation Area (OCRA)

In the OCRA all existing roads would be open to motorized use. Recreation facilities could be developed at Summit Lake, Big Marsh, and along the Little Deschutes. Additional trails for snowmobiles would be developed. Fish habitat improvements could be developed for Big Marsh and the Little Deschutes River. Tree stands that are dying or in imminent danger of insect attack could be harvested. Motorized vehicles would be restricted to the existing and planned trails and roads in summer. In winter, over the snow vehicles would be permitted.

Visual Resources

All major State and County highways and Black Butte would be protected.

Review alternative maps to identify the differences between alternatives.

Wild and Scenic Rivers

No rivers will be recommended for classification under the Wild and Scenic Rivers Act of 1968. Low-head hydropower facilities would be compatible with this Alternative.

Special Areas

Special Interest Areas are established to protect, preserve and interpret unique, scenic, biological and geological features. Existing and proposed areas are listed below:

Name	Status
Lava Butte	Existing
Lava Cast Forest	Existing
Lavacicle Cave	Existing
Wake Butte	Proposed
Lava River Cave	Proposed

Wildlife

Big Game Habitat

Thirty to 50 percent of the important deer habitat would be in thermal cover; 25 percent of the shrublands would be regenerated by burning each decade. Trees would be managed on a 70 year rotation to achieve a better quality thermal cover in those areas where deer habitat is emphasized. The habitat conditions provided could potentially support 32,300 mule deer.

Other Wildlife Habitat

Habitat for species of wildlife which use mature and old-growth forests will be at minimum levels. Habitat for cavity dwelling species would be retained at 20 percent of the maximum biological potential.

Old Growth

No special provisions for old growth are provided, however, approximately 8 percent of the Forest would be in old growth as a result of areas which remain undeveloped or are not scheduled for timber harvesting. Old growth would also be present in areas managed for spotted owls and bald eagle nesting habitat.

Energy

Geothermal

Geothermal leasing in the Newberry Crater Known Geothermal Resource Area could be permitted in the entire area. Some restrictions would be necessary to protect recreation sites and facilities.

Leasing and development could be permitted for significant portions of the remainder of the Forest not already under lease. This would make 43 percent of the high potential, 51 percent of the moderate potential, and 73 percent of the low potential areas available.

Firewood

No special provisions would be made to ensure that personal use firewood will be available. Personal use of firewood would have to compete with other markets for the wood and prices could be based primarily on market value so prices could increase significantly. The dead lodgepole which currently is the main source of firewood would become limited by 1990 and be very scarce in 1995. Residues resulting from treatment of tree stands would then become the primary source of personal use firewood.

Research Natural Areas

The Torrey-Charlton Research Natural Area would be recommended for inclusion in the Research Natural Area program.

Transportation

The Todd Lake-Three Creeks Lake road would be improved for increased traffic volume and to a standard where passenger cars could use it. The Irish-Taylor road would also be improved and upgraded. Forest Road 5897 (Waldo Lake road) would be improved to a two lane paved highway. The Windigo Pass road would improved and upgraded.

Roadless Areas

The following display indicates the proposal for each roadless area. For more details refer to Table II-3d and/or Appendix C.

Roadless Area	Developed	Partly Developed	Undeveloped
Mt. Jefferson	X		
Metolius Breaks	X		
Three Sisters	X		
West/South Bachelor	X		
Bearwallows	X		
Bend Watershed		X	
Waldo		X	
Charlton	X		
North Paulina	X		
South Paulina	X		
Maiden Peak	X		

SUMMARY OF RESULTS RELATED TO KEY ISSUES - Alt. C

ISSUE	RESULT
Timber	
Million cubic feet average annual ASQ for the first decade.	65.2
Million board feet average annual ASQ for the first decade.	290
Recreation	
Average annual MRVD's of developed recreation.	3493
Average annual MRVD's of dispersed recreation.	2686
Planned Campground Construction	Meet demand
Wildlife	
Potential mule deer population.	32,300
Potential bald eagle population (Pairs)	45
Potential osprey population (Pairs)	80
Energy	
Acres of high potential geothermal areas available for leasing.	126.1
Amount of personal use firewood provided.	Competitively Sold
Social/Economic	
Present net value	$1285.81 Million
First decade average revenues to the Government.	$ 34.9 Million
First decade average annual returns to the counties.	$ 8.7 Million

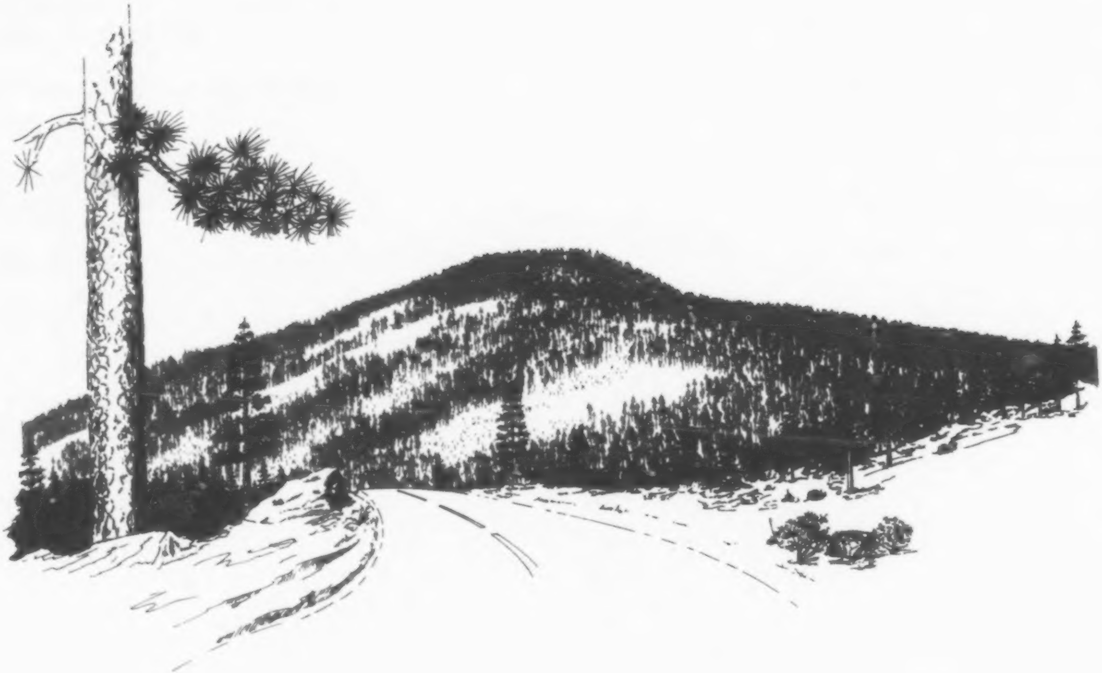


Figure IV

Alternative D

This Alternative would provide dispersed recreation opportunities combined with timber production and protection of visual resources. Recreation management would focus on providing vehicle access for single-day, short-term use. To complement the recreation emphasis of this Alternative, scenery along travel routes and areas viewed by large concentrations of people would be maintained or enhanced. A large part of the Forest would be intensively managed for timber production but would be screened from view from major roads and trails. Much of the area with geothermal potential could be leased. High levels of habitat for osprey, eagles, and deer would be provided.

Vegetation

Trees

Trees will be managed to provide cover for big game and habitat for bald eagles, to meet recreation and visual quality objectives, and to produce wood fiber and firewood. Timber would be harvested on both a chargeable (a fixed amount on an annual basis) and nonchargeable (not a fixed amount but can vary depending on the need to manipulate a stand to meet some objective) basis. Land on which recreation is emphasized would be classed as nonchargeable.

From the lands available for timber production, 95 percent are used to develop the timber program. Lands not used are generally those with lower timber values and high costs.

Timber harvesting would be scheduled based on nondeclining yield. Mature and overmature lodgepole pine stands would be converted to managed stands in 10 to 15 years.

The average annual first decade harvest would be 46.1 million cubic feet or 193 million board feet. During the first decade, 57 percent of the cubic foot volume is from lodgepole pine stands and 33 percent is from ponderosa pine stands. In the second decade this shifts to 36 percent lodgepole and 28 percent ponderosa pine. Mixed conifer species make up 10 percent of the harvest in the first decade and 36 percent in the second.

During the first decade, 65 percent of the areas harvested would be by clearcuts or shelterwoods. Approximately 15,100 acres would be reforested annually.

Range

Current levels of livestock grazing would be maintained and, if demand warranted, increases would be allowed. Full use of forage available for livestock would be emphasized. Cost effective management systems and techniques, including fencing and water development, would be designed and applied (1) to obtain relatively uniform livestock distribution and use of forage and (2) to maintain plant vigor.

Recreation

Developed Recreation

All campgrounds where a fee is charged will receive reduced service level (RSL) or a minimum standard of cleaning and maintenance. All nonfee campgrounds will be closed. Day use activities will be emphasized and all day use sites will be managed at a full service level.

No new campgrounds will be constructed. Additional day use facilities such as picnic areas and boat launch sites will be built to meet the projected public demand.

Dispersed Recreation

Fourteen percent of the unroaded lands will have an unroaded prescription, and 90 percent of the unroaded lands could remain undeveloped at the end of the second decade based on timber harvest schedules. However, roads may be developed in some areas to treat the mountain pine beetle epidemic and for geothermal exploration.

The summer trail system for horses and hikers will be maintained at the current level. Missing sections will be constructed and substandard sections will be reconstructed. A mountain bicycle trail system will be developed. Trails for motorcycles and all terrain vehicles (ATV's) will also be developed. Most of the Forest's low standard roads (those not maintained for passenger cars) will be open to off-road vehicles.

For winter recreation the existing nordic and snowmobile trail system will be maintained and expanded. Snow parks will be constructed to meet increases in demand.

Oregon Cascade Recreation Area (OCRA)

In the OCRA, roads to Summit Lake, Big Marsh, and the Little Deschutes would be upgraded and improved for day use. Facilities for day use such as picnic grounds could be provided. Fish habitat could be improved and access for fishing areas upgraded. Motorized vehicles would be restricted to existing roads, trails, and planned trails in the summer. In winter, over the snow vehicles would be permitted.

Visual Resources

This alternative has a heavy emphasis on the visual resource. All State and County highways and many Forest Service roads including those to major trailheads are protected. The same is true for all major buttes and many of the minor, less prominent buttes. Much of Green Ridge and the Horn of the Metolius is also protected.

It is important that you review the alternative maps to identify differences between alternatives.

Wild and Scenic Rivers

The Deschutes River from Wickiup Reservoir to the north Forest boundary would be recommended for classification as a Recreation River under the Wild and Scenic Rivers Act. The same would apply to the Metolius River from its source to Lake Billy Chinook and the Little Deschutes from its source to its junction with the Deschutes River. Low-head hydropower facilities would not be compatible with this Alternative, except where existing structures could be used without altering water flows.

Special Areas

Nine new Special Interest Areas would be added. They are listed below.

Name	Status
Lava Butte	Existing
Lava Cast Forest	Existing
Lavacicle Cave	Existing
Wake Butte	Proposed
Castle Rock	Proposed
Katati Butte	Proposed
Hole in the Ground	Proposed
Big Hole	Proposed
Balancing Rock	Proposed
Moffit Butte	Proposed
Lava River Cave	Proposed
Horn of the Metolius	Proposed
Hosmer Lake	Proposed

Wildlife

Big Game Habitat

Thirty to 50 percent of the important deer habitat would be maintained in thermal cover. Approximately 25 percent of the mature and decadent shrub lands would be rejuvenated by burning per decade. The amount and condition of habitat provided could provide increases in the mule deer population to 29,800.

Other Wildlife Habitat

Habitat would be managed for watchable wildlife and could result in increases in populations of osprey, spotted owls, and bald eagles. Habitat for cavity dwelling species would be retained at 40 percent of the maximum biological potential.

Old Growth

Old growth will be present on approximately 14 percent of the Forest. Some of this is a result of areas which are not developed or scheduled for timber harvesting. The remainder is a result of establishing 3 percent of the forested plant communities as old growth.

Energy

Geothermal

Geothermal leasing in the Newberry Crater KGRA could be permitted on the outside slopes of the Crater but would not be permitted inside the Crater.

Leasing and development of geothermal resources could be permitted in much of the Forest not already under lease. Thirty-nine percent of the high, 51 percent of the moderate, and 71 percent of the low potential areas would be available for leasing.

Firewood

No special provisions would be made to ensure that personal use firewood will be available. Personal use of firewood would be competitive with other markets. Prices charged would be based primarily on market value, so they could increase significantly. The dead lodgepole which currently is the main source of firewood would become limited in about 5 years and would be very scarce in 10 years. Residues resulting from treatment of tree stands would then become the primary source of personal use firewood.

Research Natural Areas

Torrey-Charlton and Wechee Butte would be recommended for inclusion in the Research Natural Area program.

Transportation

The Todd Lake to Three Creeks Lake road would be upgraded and improved. The Irish-Taylor road would also be upgraded and improved to support higher levels of day use recreation. The same would apply to the Windigo Pass road. Forest Highway 46 (Waldo Lake road) would improved to a paved 2 lane highway.

Roadless Areas

The following display indicates the proposal for each roadless area. For more details refer to Table II-3c and/or Appendix C.

Roadless Area	Developed	Partly Developed	Undeveloped
Mt. Jefferson	X		
Metolius Breaks	X		
Three Sisters	X		
West/South Bachelor	X		
Bearwallows	X		
Bend Watershed		X	
Waldo		X	
Charlton	X		
North Paulina		X	
South Paulina		X	
Maiden Peak		X	

SUMMARY OF RESULTS RELATED TO KEY ISSUES - Alt. D

ISSUE	RESULT
Timber	
Million cubic feet average annual ASQ for the first decade.	46.1
Million board feet average annual ASQ for the first decade.	193
Recreation	
Average annual MRVD's of developed recreation.	2983
Average annual MRVD's of dispersed recreation.	2551
Planned Campground Construction	None
Wildlife	
Potential mule deer population.	29,800
Potential bald eagle population (pairs)	45
Potential osprey population (pairs)	150
Energy	
M Acres of high potential geothermal areas available for leasing.	114
Amount of personal use firewood provided.	Competitively Sold
Social/Economic	
Present net value	$ 1121.25 million
First decade annual revenues to the government.	$ 20.6 Million
First decade average annual returns to the counties.	$ 5.2 Million

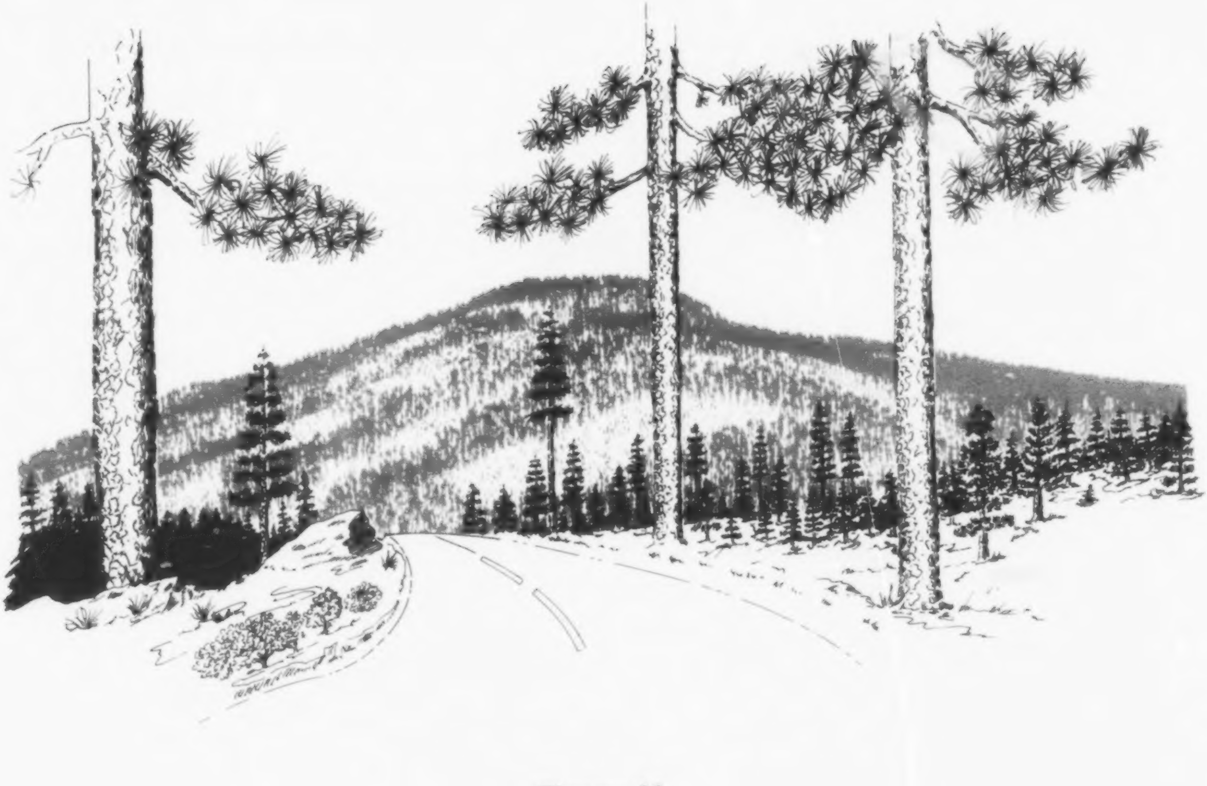


Figure V

Alternative E—Preferred

This Alternative is similar to Alternatives B and F but different prescriptions have been applied to specific areas of the Forest. You will need to consult the maps to fully understand the differences between these Alternatives.

Alternative E provides for moderately high levels of timber outputs. The Forest would be intensively used and developed, but options for maintaining undeveloped lands and old-growth ecosystems would be retained.

A mix of developed and undeveloped recreation opportunities would be provided. This Alternative would provide for increases in deer and bald eagle populations. Some of the higher potential geothermal areas are available for leasing and others are not.

Scenic quality would be provided along heavily used roads, developed recreation areas, and some roads to trailheads.

Vegetation

Trees

Trees will be managed to provide cover for big game and habitat for bald eagles, to meet recreation and visual quality objectives, and to produce wood fiber and firewood. Timber would be harvested on both a chargeable (a fixed amount on an annual basis) and nonchargeable (not a fixed amount but can vary depending on the need to manipulate a stand to meet some objective) basis. Where recreation is emphasized, the lands are classed as nonchargeable.

Of the lands suitable for timber production, timber harvesting is scheduled on 88 percent of the area. The relatively few acres of lands not programmed for timber harvesting are generally of lower timber value and higher management costs.

Timber harvest scheduling would be based upon a departure from nondeclining yield in order to convert surplus overmature and mature stands to more vigorous managed stands, to meet the RPA timber targets, and convert the dying lodgepole pine in 15 years. After departing from nondeclining yield for the first 6 decades, the harvest schedule drops to the long-term sustained yield level of 39.5 MMCF per year below which it never falls. During the departure, the harvest levels from one decade to the next never vary by more than 5 percent.

The average annual wood output is 51.6 cubic feet or 225 million board feet in the first decade. Generally, mature and overmature lodgepole pine would be converted to managed stands in 15 to 20 years. In the first decade, 49 percent of the cubic foot volume is from lodgepole pine stands and 33 percent is from ponderosa pine stands. This shifts to 42 percent lodgepole pine in the second decade and 29 percent ponderosa pine. Mixed conifer species is 18 percent of the volume in the first decade and shifts to 28 percent in the second.

In the first decade 63 percent of the acres programmed for harvest would be clearcuts or shelterwood cuts. Approximately 16,100 acres would be reforested annually.

Range

Use of vacant grazing allotments would be encouraged. Full utilization of forage available for livestock would be emphasized. Range investments would be increased above current levels. Cost effective management systems and techniques, including fencing and water development, would be designed and applied (1) to obtain relatively uniform livestock distribution and use of forage and (2) to maintain plant vigor.

Recreation

Developed Recreation

All campgrounds where a fee is charged will receive a Full Service Level of cleaning and maintenance. Nonfee campgrounds will receive Reduced Service Level (RSL) or a minimum standard of cleaning and maintenance. Day use sites, other than those associated with fee campgrounds, will be managed at RSL. Very few sites will be closed.

New campgrounds will be constructed to meet increasing demand. Additional day use facilities such as picnic areas and boat launch sites will be built but this will not meet the projected demand. Some sites may be built and operated by private developers.

Dispersed Recreation

Thirty-one percent of the unroaded lands will have an undeveloped prescription and 84 percent of the unroaded lands could remain undeveloped at the end of the second decade based on the timber harvest schedule. However, roads may be developed in some areas to treat the mountain pine beetle epidemic and for geothermal exploration.

The summer trail system for horses and hikers will be maintained at the current level. Missing sections will be constructed and substandard sections will be reconstructed. A mountain bicycle trail system will be developed. Trails for motorcycles and all terrain vehicles (ATV's) will also be developed. Most of the Forest's low standard roads (those not maintained for passenger cars) will be open to off-road vehicles.

For winter recreation the existing nordic and snowmobile trail system will be maintained and expanded. Snow parks will be constructed to meet increases in demand.

Oregon Cascade Recreation Area (OCRA)

In the OCRA, all existing roads would remain open for motorized use and would be maintained in the current condition. Wildlife and fish habitat could be improved in the Big Marsh drainage. Tree stand damage by insect or fire could be harvested and any new roads would be closed following harvest. Motorized vehicle use would be limited to existing roads and trails in the summer with no restrictions to over-the-snow vehicles in winter. Domestic livestock grazing is permitted where compatible with wildlife and recreation values.

Visual Resources

All State and County highways and many Forest Service roads including those to major trailheads, are protected. Most major buttes are also protected, but only part of the areas seen west of Davis Lake are protected. The area south of Mt. Bachelor and most of Pine Mountain are also protected.

It is important to review the alternative maps to identify the major differences between Alternatives B, E, and F.

Wild and Scenic Rivers

Sections of the Deschutes, from Spring River to the north Forest boundary and the Metolius River from its source to Bridge 99, would be recommended for inclusion in the Wild and Scenic River system as Recreation Rivers. Low-head hydropower facilities would not be compatible in areas recommended for classification.

Special Areas

Additional Special Interest Areas would be included because of unusual geological or botanical features. They are shown below:

Name	Status
Lava Butte	Existing
Lava Cast Forest	Existing
Lavacicle Cave	Existing
Wake Butte	Proposed
Castle Rock	Proposed
Katati Butte	Proposed
Hole in the Ground	Proposed
Big Hole	Proposed
Balancing Rock	Proposed
Moffit Butte	Proposed
Lava River Cave	Proposed
Davis Lake	Proposed
Hosmer Lake	Proposed

Wildlife Habitat

Big Game Habitat

Thirty to 50 percent of the important deer habitat would be maintained in thermal cover. Approximately 25 percent of the shrub communities would be regenerated to younger shrub classes by prescribed burns each decade. The amount and condition of habitat could provide for increases in the mule deer population to 25,900 animals.

Other Wildlife Habitat

Habitat for cavity dwelling species would be provided at 60 percent of the maximum biological potential. Habitat for osprey would decrease.

Old Growth

Old growth will be present on approximately 12 percent of the Forest. Some of this is a result of areas which are not developed or scheduled for timber harvesting. The remainder is a result of establishing 5 percent of the forested plant communities as old growth.

Energy

Newberry Crater Known Geothermal Resource Area

Geothermal leasing in the Newberry Crater KGRA could be permitted on portions of the Area.

Geothermal leasing could be permitted in some additional areas not already under lease. As a result 37 percent of the high potential areas, 49 percent of the moderate, and 69 percent of the low would be available for leasing.

Firewood

Twenty million board feet (60,000 cords) would be made available annually for personal use firewood. Until 1995, mature dead and dying lodgepole pine would comprise a large part of this wood. Beyond that, the type of material would shift to other products and species. The amount available per individual permit would be adjusted based upon demand. Should demand continue to increase, the amount per permit could be decreased. Demand could reach a point where it may be necessary to limit the number of permits issued. The price of personal use firewood would trend upward and be re-evaluated each year. Areas where personal use firewood cutting would be emphasized could also be determined on an annual basis. The trend, however, would be that cutting areas would be located further and further from Bend and LaPine as time passed. By 1995, much of the emphasis would be on the Fort Rock and Crescent Districts.

Research Natural Areas

The following areas would be recommended for inclusion in the Research Natural Area program:

Cache Mountain
Cultus River
Katsuk Butte
Torrey-Charlton
Many Lakes
Wechee Butte
Mokst Butte

Transportation

The Todd Lake to Three Creeks Lake road would be maintained to its current condition. The same would apply to the Irish-Taylor road. The Windigo Pass road would be improved some for increased traffic volume. Forest Road 5897 (Waldo Lake road) could be improved to a 2 lane paved highway.

Roadless Areas

The following display indicates the proposal for each roadless area. For more details refer to Table II-3d and/or Appendix C.

Roadless Area	Developed	Partly Developed	Undeveloped
Mt. Jefferson	X		
Metolius Breaks		X	
Three Sisters		X	
West/South Bachelor	X		
Bearwallows	X		
Bend Watershed		X	
Waldo		X	
Charlton		X	
North Paulina		X	
South Paulina		X	
Maiden Peak		X	

SUMMARY OF RESULTS RELATED TO KEY ISSUES - Alt. E

ISSUE	RESULT
Timber	
Million cubic feet average annual ASQ for the first decade.	51.6
Million board feet average annual ASQ for the first decade.	225
Recreation	
Average annual MRVD's of developed recreation.	2770
Average annual MRVD's of dispersed recreation.	2493
Planned Campground Construction	Meet Demand
Wildlife	
Potential mule deer population.	25,900
Potential bald eagle population (pairs)	45
Potential osprey population (pairs)	80
Energy	
M Acres of high potential geothermal areas available for leasing.	108.3
Amount of personal use firewood provided.	60,000 cords
Social/Economic	
Present net value	$ 1123.4 Million
First decade average revenues to the Government.	$ 26.0 Million
First decade average annual returns to the counties.	$ 6.5 Million

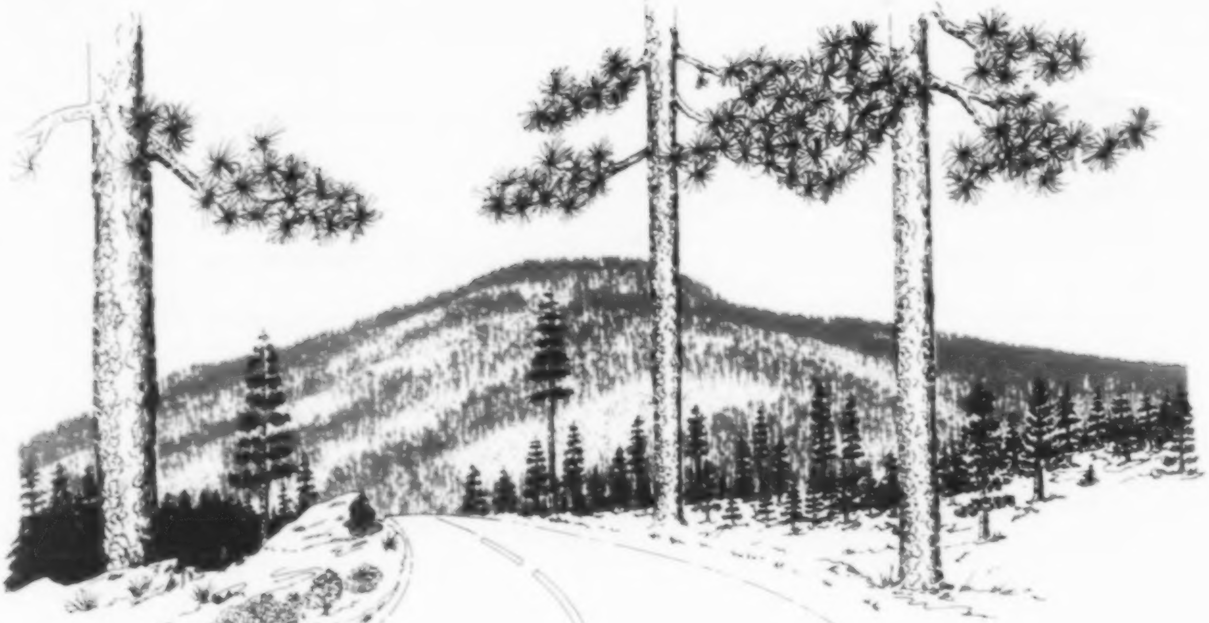


Figure VI

Alternative F

Management under Alternative F would be to provide moderate levels of resource outputs. It would provide for intensive use and development of the Forest, but some portions of the Forest would be retained as undeveloped lands and old-growth ecosystems.

A mix of developed and dispersed recreation opportunities would be provided. Emphasis would be placed on maintaining current hunting opportunities and on increasing threatened and endangered species habitat and populations. Some of the higher potential geothermal areas would not be available for leasing.

Scenic quality would be protected along heavily used roads, developed recreation areas, and some roads to trailheads.

Vegetation

Trees

Trees will be managed to provide cover for big game and habitat for bald eagles, to meet recreation and visual quality objectives, and to produce wood fiber and firewood. Management of the trees results in timber harvesting on both a chargeable (fixed amount on an annual basis) and nonchargeable (not a fixed amount but can vary depending on the need to manipulate a stand to meet some objective) basis. On lands where recreation is emphasized, timber harvesting would be nonchargeable.

From the lands available for timber production, timber harvesting is programmed on 94 percent of them. Lands not programmed generally had low value timber with high management costs.

Timber harvesting would be scheduled on a nondeclining yield basis. Mature lodgepole pine would be converted to manage stands in a 20 year period. Total average annual volume provided is 43.7 cubic feet or 195 million board feet. During the first decade, 43 percent of the total cubic foot volume is from lodgepole pine stands, and 41 percent is from ponderosa pine stands. In the second decade this shifts to 52 percent lodgepole pine and 15 percent ponderosa pine. Mixed conifer species make up 16 percent of the first decade harvest and 33 percent in the second decade.

During the first decade, 56 percent of the acres scheduled for harvest would be clearcuts and shelterwoods. Approximately 12,000 acres would be reforested annually.

Range

Use of vacant grazing allotments would be encouraged. Full use of forage available for livestock would be emphasized. Range investments would be increased above current levels. Cost effective management systems and techniques, including fencing and water development, would be designed and applied (1) to obtain relatively uniform livestock distribution and use of forage and (2) to maintain plant vigor.

Recreation

Developed Recreation

Ninety percent of all campgrounds where a fee is charged will receive the Full Service Level (FSL) of cleaning and maintenance. Nonfee campgrounds will receive Reduced Service Level (RSL) or a minimum standard of cleaning and maintenance. Day use sites will be managed at RSL. A few low use sites will be closed.

New campgrounds and day use facilities such as boat launches and picnic areas will be built but they will only meet 50 percent of the projected demand. Some of these sites may be built and operated by the public sector.

Dispersed Recreation

Forty-two percent of the unroaded lands will have an undeveloped prescription and 93 percent of the unroaded lands could remain undeveloped at the end of the second decade based on the timber harvest schedule. However, roads may be developed in some areas to treat the mountain pine beetle epidemic and for geothermal exploration.

The summer trail system for horses and hikers will be maintained at the current level. Missing sections will be constructed and substandard sections will be reconstructed. A mountain bicycle trail system will be developed. Trails for motorcycles and all terrain vehicles (ATV's) will also be developed. Most of the Forest's low standard roads (those not maintained for passenger cars) will be open to off-road vehicles.

For winter recreation the existing nordic and snowmobile trail system will be maintained and expanded. Snow parks will be constructed to meet increases in demand.

Oregon Cascade Recreation Area (OCRA)

In the OCRA all existing roads will remain open to motorized use. The road up the Little Deschutes and to Big Marsh would be improved. The Summit Lake Road would remain in its existing condition. Wildlife habitat could be improved through timber harvesting in the Big Marsh drainage by using the existing road system. Motorized vehicles would be restricted to existing roads and trails in the summer with no restriction on over the snow vehicles in winter.

Visual Resources

All State and County highways and many Forest Service roads including those to major trailheads, are protected. Most major buttes are also protected, but only part of the area seen west of Davis Lake is protected. The areas south of Mt. Bachelor and most of Pine Mountain are also protected.

It is important to review the alternative maps to identify the major differences between Alternatives B, E, and F.

Wild and Scenic Rivers

The Metolius River from its source to Bridge 99 would be recommended for classification as a Recreation River under the Wild and Scenic Rivers Act. Low-head hydropower facilities on the Deschutes River would be compatible.

Special Areas

Status of the Special Interest Areas is shown below.

Name	Status
Lava Butte	Existing
Lava Cast Forest	Existing
Lavacicle Cave	Existing
Wake Butte	Proposed
Castle Rock	Proposed
Katati Butte	Proposed
Hole in the Ground	Proposed
Big Hole	Proposed
Balancing Rock	Proposed
Moffit Butte	Proposed
Horn of the Metolius	Proposed
Hosmer Lake	Proposed

Wildlife Habitat

Big Game Habitat

Important deer habitat would be managed to retain 30 to 50 percent of the area in thermal cover. Approximately 25 percent of the mature and decadent shrub communities would be regenerated by prescribed burn each decade. The amount and condition of habitat could provide for increases in the mule deer population to 27,100.

Other Wildlife Habitat

Habitat for cavity dwelling species would be retained for 60 percent of the maximum biological potential.

Old Growth

Old growth will be present on approximately 14 percent of the Forest. Some of this is a result of areas which are not developed or scheduled for timber harvesting. The remainder is a result of establishing 5 percent of the forested plant communities as old growth.

Energy

Geothermal

Geothermal leasing in the Newberry Crater KGRA could be permitted outside the Crater but not inside.

Geothermal leasing could be permitted in some additional areas on the Forest which are not already under lease. As a result, 33 percent of the high potential areas, 49 percent of the moderate, and 70 percent of the low would be available for leasing.

Firewood

Twenty million board feet (60,000 cords) would be made available annually for personal use firewood. Until 1995, mature dead and dying lodgepole pine would comprise a large part of this wood. Beyond that, the type of material would shift to other products and species. The amount available per individual permit would be adjusted based upon demand. Should demand continue to increase, the amount per permit could be decreased. Demand could reach a point where it may be necessary to limit the number of permits issued. The price of personal use firewood would trend upward and be re-evaluated each year. Areas where personal use firewood cutting would be emphasized could also be determined on an annual basis. The trend, however, would be that cutting areas would be located further and further from Bend and LaPine as time passed. Until 1995, much of the emphasis would be on the Fort Rock and Crescent Districts.

Research Natural Areas

The following areas would be recommended for inclusion in the Research Natural Area program:

Cache Mountain
Cultus River
Katsuk Butte
Torrey-Charlton
Many Lakes
Wechee Butte
Mokst Butte

Transportation

Windigo Pass and the Todd Lake to Three Creek Lakes road would be maintained in their current condition and would not be improved. The same would apply to the Irish-Taylor road. Forest road 5897 (Waldo Lake road) would be improved but would not be developed into a paved highway.

Roadless Areas

The following display indicates the proposal for each roadless area. For more details refer to Table II-3d and/or Appendix C.

Roadless Area	Developed	Partly Developed	Undeveloped
Mt. Jefferson	X		
Metolius Breaks		X	
Three Sisters		X	
West/South Bachelor		X	
Bearwallows	X		
Bend Watershed		X	
Waldo		X	
Charlton		X	
North Paulina	X		
South Paulina	X		
Maiden Peak		X	

SUMMARY OF RESULTS RELATED TO KEY ISSUES - Alt. F

ISSUE	RESULT
Timber	
Million cubic feet average annual ASQ for the first decade.	43.7
Million board feet average annual ASQ for the first decade.	195
Recreation	
Average annual MRVD's of developed recreation.	2638
Average annual MRVD's of dispersed recreation.	2418
Planned Campground Construction	50% of demand
Wildlife	
Potential mule deer population.	27,100
Potential bald eagle population (pairs).	45
Potential osprey population (pairs).	80
Energy	
M Acres of high potential geothermal areas available for leasing.	97.1
Amount of personal use firewood provided.	60,000 cords
Social/Economic	
Present net value	1125.21
First decade average revenues to the Government.	$ 24.2 Million
First decade average annual returns to the counties.	$ 6.0 million

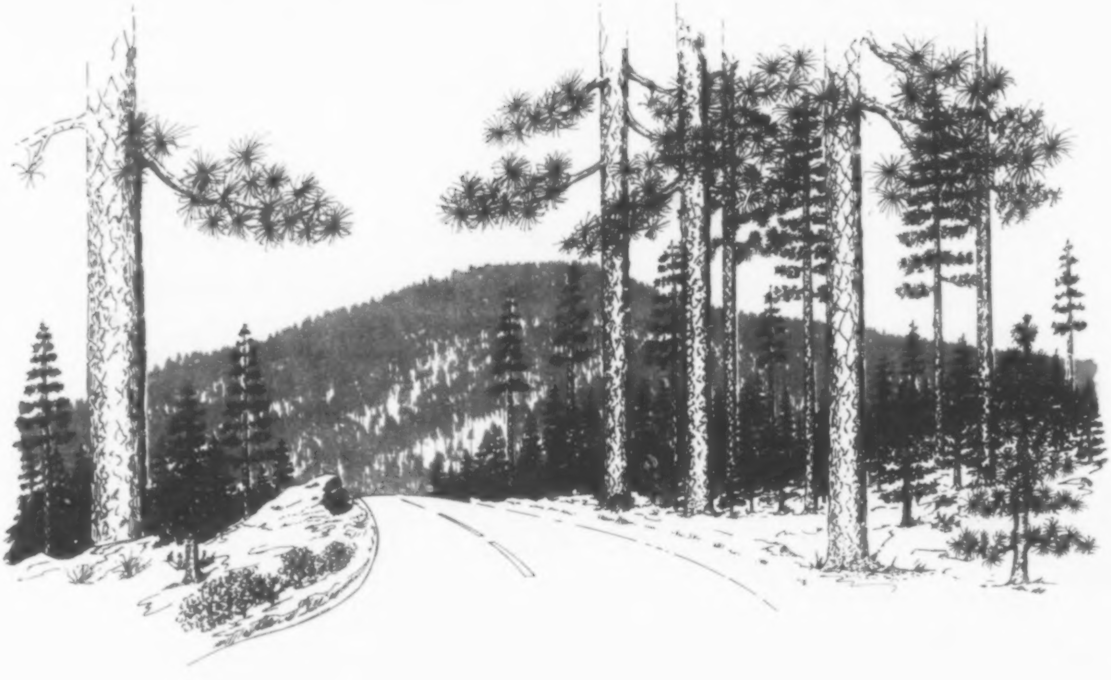


Figure VII

Alternative G

The goal of this Alternative is to provide for high levels of amenity values.

This Alternative provides for ecosystem preservation by having significant acres of the roadless areas remain unroaded. Areas available for timber production would be reduced.

A wide range and large amount of recreation opportunities would be provided but emphasis would be on activities not requiring large or sophisticated developed sites such as fishing, tent camping, cross-country skiing, and hiking. Scenic resources would be emphasized along heavily traveled roads and other roads and areas receiving high amounts of recreation use.

Habitat for threatened and endangered plants and wildlife species and old-growth ecosystems would be provided at high levels.

Vegetation

Trees

Trees will be managed to provide cover for big game and habitat for bald eagles, to meet recreation and visual quality objectives, and to produce wood fiber and firewood. Timber is harvested on both a chargeable (a fixed amount on an annual basis) and nonchargeable (not a fixed amount but can vary depending on the need to manipulate a stand to meet some objective) basis. On lands where recreation and visual quality are emphasized, the lands would be classed as nonchargeable.

Of the lands available for timber production, timber harvesting is scheduled on 98 percent of them. Lands not programmed were unroaded or generally had low value species and high management costs.

The timber harvest level would be based on nondeclining yield. The average annual first decade harvest would be 36.8 million cubic feet or 173 million board feet. Mature and overmature lodgepole pine would be converted to managed stands in 30 years. During the first decade, 30 percent of the total cubic foot volume is from lodgepole pine stands and 54 percent is from ponderosa pine stands. This shifts to 35 percent lodgepole pine in the second decade with 27 percent being ponderosa pine. Mixed conifer species is 16 percent of the harvest in the first decade and 39 percent in the second.

During the first decade, 44 percent of the area scheduled for harvest would be clearcuts and shelterwoods. Approximately 7,800 acres would be reforested annually.

Range

Livestock levels would be maintained at current levels. Cost effective management systems and techniques, including fencing and water development, would be designed and applied (1) to obtain relatively uniform livestock distribution and use of forage and (2) to maintain plant vigor.

Recreation

Developed Recreation

All campgrounds where a fee is charged will receive Reduced Service Level (RSL) or minimum standard of cleaning and maintenance. All nonfee campgrounds will be closed. All day use sites will also receive the RSL standard of maintenance.

No new campgrounds will be constructed. Some new day use sites associated with nonmotorized activities such as trailheads leading into the Wilderness will be constructed.

Dispersed Recreation

Eighty-five percent of the unroaded lands will have an undeveloped prescription and 100 percent of the unroaded lands will remain undeveloped at the end of the second decade because of the timber harvest schedule.

The summer trail system for horses and hikers will be maintained at the current level. Missing sections will be constructed and substandard sections will be reconstructed. A mountain bicycle trail system will be developed. The nordic trail system will also be maintained and expanded. The motorized trail system for snowmobiles, motorcycles, and all-terrain vehicles will be deemphasized.

Oregon Cascade Recreation Area (OCRA)

In the OCRA, the road up the Little Deschutes River would be closed to motorized use. The road up Big Marsh above Otter Creek would also be closed to motorized use. The Summit Lake Road would remain open and be maintained at its current condition. No timber would be harvested unless it was a direct hazard to the users of the area.

Motorized vehicles would not be permitted on trails or in any other part of the area in the summer. Over-the-snow vehicles would be permitted in the winter.

Visual Resources

Major acreages in this allocation remain undeveloped. In those areas available for development, the major State and County highways and the major Forest Service roads are protected. The major buttes are also protected.

Please review the alternative maps to identify the differences between alternatives.

Wild and Scenic Rivers

The Deschutes River from Wickiup Reservoir to the Forest boundary near Sunriver would be recommended as a Recreation River. From there to the north Forest boundary it would be recommended as a Scenic River. The entire length of the Metolius River would be recommended for designation as a Recreation River. The Little Deschutes River from its source to the Deschutes would be recommended as a Recreation River as well as Big Marsh Creek from the Oregon Cascade Recreation Area boundary to Crescent Creek. Low-head hydropower facilities would not be compatible in sections of rivers recommended for classification.

Special Areas

All areas with identified special botanical or geological features not protected would be given protection or interpretation under this Alternative.

Name	Status
Lava Butte	Existing
Lava Cast Forest	Existing
Lavacicle Cave	Existing
Wake Butte	Proposed
Castle Rock	Proposed
Katati Butte	Proposed
Hole in the Ground	Proposed
Big Hole	Proposed
Balancing Rock	Proposed
Moffit Butte	Proposed
Lava River Cave	Proposed
Hosmer Lake	Proposed

Wildlife Habitat

Big Game Habitat

At least 30 percent of the important deer habitat would be maintained in thermal cover. Prescribed burning would not be emphasized. The mule deer population could decline below current levels to 16,700.

Other Wildlife Habitat

Habitat for cavity dwelling species would be provided for at 80 percent of maximum biological potential. Osprey and Bald eagle populations could increase.

Old Growth

Old growth will be present on approximately 18 percent of the Forest. Some of this is a result of areas which are not developed or scheduled for timber harvesting. The remainder is a result of establishing 10 percent of the forested plant communities as old growth.

Energy

Geothermal

Geothermal leasing in the Newberry Crater KGRA would not be permitted in the majority of the Area. Some small areas around the edge would be available.

Geothermal leasing in roadless areas could be permitted except in those allocated to Undeveloped Recreation. As a result, 20 percent of the high potential areas would be available for leasing, 47 percent of the moderate, and 69 percent of the low.

Firewood

Initially 25 million board feet (75,000 cords) would be made available for personal use firewood. The amount made available would be adjusted to match demand, should it change. Some adjustment in the amount available per individual permit might also be necessary. The price of personal use firewood would trend upward very gradually. Areas where personal use firewood cutting is emphasized would be determined on an annual basis. The trend, however, would be that cutting areas would be located further and further from Bend and LaPine as time passed. By 1995, much of the emphasis would be on the Fort Rock and Crescent Districts. By 2005, mature dead and dying lodgepole pine would comprise a large part of this wood. Beyond that, the type of material would shift to other products and species.

Research Natural Areas

The following areas would be recommended for inclusion in the Research Natural Area program:

Cache Mountain
Cultus River
Katsuk Butte
Torrey-Charlton
Many Lakes
Wechee Butte
Mokst Butte

Transportation

The Todd Lake to Three Creeks Lake and Irish-Taylor roads would be closed. The Waldo Lake road, would be maintained in its present condition as well as the Windigo Pass road.

Roadless Areas

The following display indicates the proposal for each roadless area. For more details refer to Table II-3d and/or Appendix C. None of the roadless areas are developed in the first decade.

Roadless Area	Developed	Partly Developed	Undeveloped
Mt. Jefferson			X
Metolius Breaks			X
Three Sisters			X
West/South Bachelor			X
Bearwallows			X
Bend Watershed			X
Waldo			X
Charlton			X
North Paulina			X
South Paulina			X
Maiden Peak			X

SUMMARY OF RESULTS RELATED TO KEY ISSUES - Alt. G

ISSUE	RESULT
Timber	
Million cubic feet average annual ASQ for the first decade.	36.8
Million board feet average annual ASQ for the first decade.	173
Recreation	
Average annual MRVD's of developed recreation.	2045
Average annual MRVD's of dispersed recreation.	2255
Planned Campground Construction	None
Wildlife	
Potential mule deer population.	16,700
Potential bald eagle population (pairs).	50
Potential osprey population (pairs).	180
Energy	
M Acres of high potential geothermal areas available for leasing.	59.8
Amount of personal use firewood provided.	75,000 cords
Social/Economic	
Present net value	$ 661.3 Million
First decade average revenues to the Government.	$ 23.8 Million
First decade average annual returns to the counties.	$ 6.0 Million

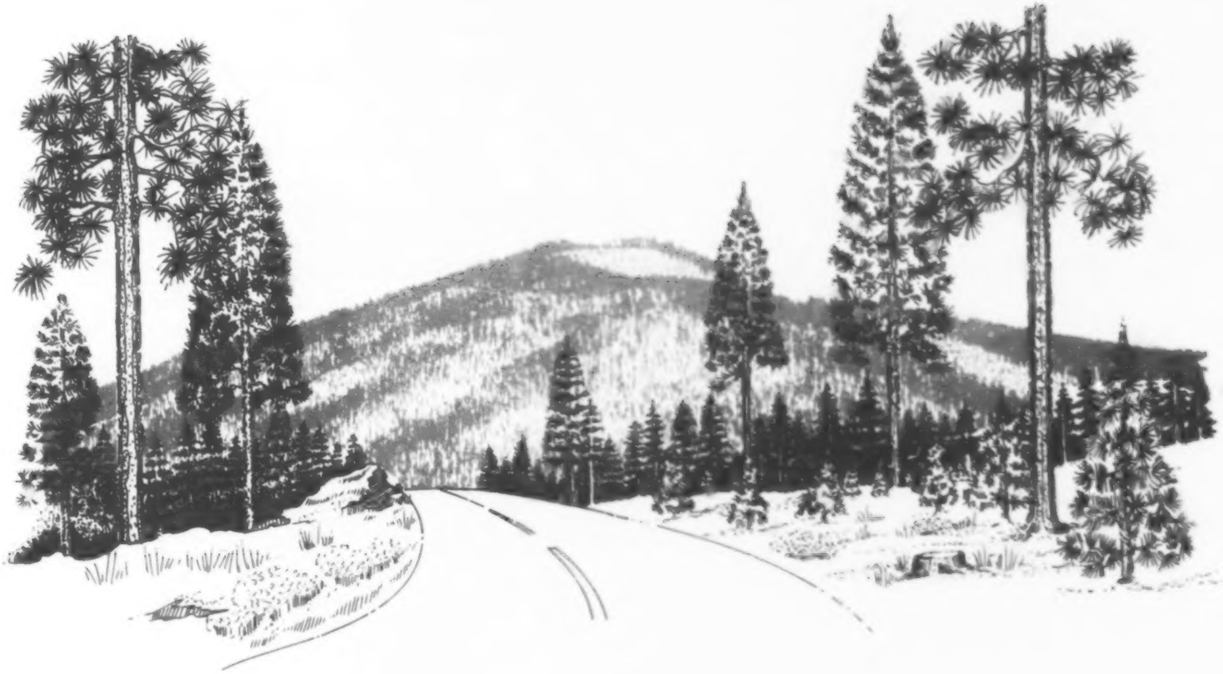


Figure VIII

Alternative H

The goal of this Alternative is to maintain high levels of production from lands that are already developed while retaining much of the roadless land in an undeveloped condition.

Intensive timber management practices could be used, but on less area.

A wide range and large amount of recreation opportunities would be provided, but emphasis would be on activities not requiring large or sophisticated developed sites, such as fishing, tent camping, cross-country skiing, and hiking.

Scenic resources would be emphasized along heavily traveled roads and other roads and areas receiving high amounts of recreation use.

Threatened and endangered plants and wildlife species and old-growth ecosystems would be emphasized.

Vegetation

Trees

Trees will be managed to provide cover for big game and habitat for bald eagles, to meet recreation and visual quality objectives, and to produce wood fiber and firewood. Timber will be harvested on a chargeable (a fixed amount on an annual basis) and nonchargeable (not a fixed amount but can vary depending on the need to manipulate a stand to meet some objective) basis. On lands where recreation is emphasized, the lands would be classed as nonchargeable.

Of the lands available, 99 percent are used to develop the scheduled timber program. Lands not programmed are generally lower value timber values with high management costs.

Timber harvesting would be scheduled based upon a departure from nondeclining yield. The decline in wood outputs begins in the sixth decade and continues until the ninth decade. The average annual first decade harvest is 47.1 million cubic feet or 212 million board feet.

Mature lodgepole would be converted from managed stands in 20 years, except where visual resources are provided for and it would be converted in 30 years.

The average annual first decade wood output is 41.7 million cubic feet or 187 million board feet. In the first decade, 39 percent of the cubic foot volume is from lodgepole pine stands and 42 percent is from ponderosa pine stands. This shifts to 53 percent lodgepole pine in the second decade and 26 percent ponderosa pine. Mixed conifer species make up 19 percent of the volume in the first decade and 21 percent in the second decade.

During the first decade, 39 percent of the area harvested is by clearcuts and shelterwoods. Approximately 12,100 acres will be reforested annually.

Range

Full use of forage available to livestock would be emphasized.

Cost effective management systems and techniques, including fencing and water development, would be designed and applied (1) to obtain relatively uniform livestock distribution and use of forage, and (2) to maintain plant vigor.

Recreation

Developed Recreation

Fifty percent of fee campgrounds where a fee is charged will receive the Full Service Level (FSL) of cleaning and maintenance. The remainder of the fee campgrounds will receive Reduced Service Level (RSL) or a minimum standard of cleaning and maintenance. Half of the nonfee campgrounds will be closed. The other half will receive reduced service level maintenance. All day use sites will also receive RSL maintenance.

No new campgrounds will be constructed. Some day use sites that emphasize nonmotorized activities will be constructed.

Dispersed Recreation

Seventy-two percent of the unroaded lands will have an undeveloped prescription and 96 percent of the unroaded lands will remain undeveloped at the end of the second decade based on the timber harvest schedule.

The summer trail system for horses and hikers will be maintained at the current level. Missing sections will be constructed and substandard sections will be reconstructed. A mountain bicycle trail system will be developed. The nordic trail system will also be maintained and expanded. The motorized trail system for snowmobiles, motorcycles, and all-terrain vehicles will be deemphasized.

Oregon Cascade Recreation Area (OCRA)

All roads and unroaded areas in the OCRA would be closed to motorized use except Summit Lake Road where snowmobiles in the winter would be permitted. Wildlife habitat improvements would be limited to the immediate Big Marsh area. Livestock grazing would not be permitted.

Visual Resources

Major State and County highways and a few Forest Service roads are protected. Major buttes and the Metolius Corridor are also protected.

Please review alternative maps to identify the differences between alternatives.

Wild and Scenic Rivers

The Deschutes River from Wickiup Dam to Sunriver would be recommended for classification as a Recreation River and from Sunriver to the Forest boundary it would be classified as a Scenic River. The Metolius, from its source to Lake Billy Chinook, would be recommended as a Recreation River. All of the Little Deschutes River, Big Marsh, and Crescent Creeks would be recommended for a Recreation classification.

Low-head hydropower facilities would not be compatible in streams and rivers recommended for these classifications.

Special Areas

All areas with identified, special botanical or geological features not protected would be given protection or interpretation under this Alternative.

Name	Status
Lava Butte	Existing
Lava Cast Forest	Existing
Lavacicle Cave	Existing
Wake Butte	Proposed
Castle Rock	Proposed
Katati Butte	Proposed
Hole in the Ground	Proposed
Big Hole	Proposed
Balancing Rock	Proposed
Moffit Butte	Proposed
Lava River Cave	Proposed
Hosmer Lake	Proposed

Wildlife

Big Game

At least 25 percent of the important deer habitat would be maintained in thermal cover. The amount of important habitat and condition of it would result in a population of 13,300 mule deer.

Other Wildlife

Snags would be provided to support 80 percent of the maximum potential population level of cavity dwelling species. Bald eagle and osprey populations could increase.

Old Growth

Old growth will be present on approximately 12 percent of the Forest. Some of this is a result of areas which are not developed or scheduled for timber harvesting. The remainder is a result of establishing 10 percent of the forested plant communities as old growth.

Energy

Geothermal

Leasing would not be permitted in a large portion of the Newberry Crater KGRA. A small area outside of the Crater would be available.

Geothermal leasing in the rest of the Forest not already under lease would be very limited. This would result in 24 percent of the high potential areas being available for leasing, 47 percent of the moderate, and 69 percent of the low.

Firewood

Twenty-five million board feet (75,000 cords) would be made available for personal use firewood initially. Should demand change, the amount made available would be adjusted to match demand. Some adjustment in the amount available per individual permit might also be necessary. The price of personal use firewood would trend very gradually upward. Areas where personal use firewood cutting would be emphasized would be determined yearly. The trend, however, would be that cutting areas would be located further and further from Bend and LaPine as time passed. During the first 10 years, much of the emphasis would be on the Fort Rock and Crescent Districts. During the first 20 years, mature dead and dying lodgepole pine would comprise a large part of this wood. Beyond that, the type of material would shift to other products and species.

Research Natural Areas

The following areas would be recommended for inclusion in the Research Natural Area programs.

Cache Mountain
Cultus River
Katsuk Butte
Torrey Charlton
Many Lakes
Wechee Butte Mokst Butte

Transportation

The Todd Lake to Three Creeks Lake and the Irish-Taylor roads would be closed. Forest road 5897 (Waldo Lake road) and Windigo Pass would be maintained in their current condition.

Roadless Areas

The following display indicates the proposal for each roadless area. For more details refer to Table II-3d and/or Appendix C. No development of roadless areas is scheduled in the first decade.

Roadless Area	Developed	Partly Developed	Undeveloped
Mt. Jefferson		X	
Metolius Breaks		X	
Three Sisters		X	
West/South Bachelor		X	
Bearwallows		X	
Bend Watershed		X	
Waldo		X	
Charlton			X
North Paulina		X	
South Paulina		X	
Maiden Peak			X

SUMMARY OF RESULTS RELATED TO KEY ISSUES - Alt. H

ISSUE	RESULT
Timber	
Million cubic feet average annual for the first decade.	47.1
Million board feet average annual for the first decade.	212
Recreation	
Average annual MRVD's of developed recreation.	2310
Average annual MRVD's of dispersed recreation.	2220
Planned Campground Construction	None
Wildlife	
Potential mule deer population.	13,300
Potential bald eagle population.	45
Potential osprey population.	180
Energy	
M Acres of high potential geothermal areas available for leasing.	68.8
Amount of personal use firewood provided.	75,000 cords
Social/Economic	
Present net value	$ 1027.2 Million
First decade average revenues to the government.	$ 26.3 Million
First decade average annual returns to the counties.	$ 6.6 Million

READEX FICHE

Comparison of Alternatives Considered in Detail

Overview

This section will present the alternatives in a way that they can be easily compared. The aspects of the alternatives that will be presented for comparison include:

- responsiveness to issues and concerns,
- management areas,
- resource outputs,
- environmental effects,
- and costs and benefits.

In addition to tables presenting information, there are narrative sections describing differences between the alternatives. Throughout the tables and text, reference is made to five decades. A Plan covers a 10- to 15-year period so the first decade outputs and effects are those that would occur during the life of the Plan. The outputs and effects for the remaining decades are potential outputs and effects that might occur if an alternative were carried beyond the first 10 to 15 years.

The purpose of Forest planning is to identify and select for implementation the alternative that most nearly maximizes net public benefits. Net public benefits are defined as the "...overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not . . . consistent with the principles of multiple use and sustained yield" (36 CFR 219.3).

No mathematical formula to define the preferred alternative is available. Indeed, there are differences of opinion about whether particular effects of alternatives are positive or negative. Therefore, it is necessary to separately identify all the major effects of each alternative as the basis for review, judgment, and an eventual selection.

Issues and Concerns

Alternatives are different ways of responding to issues and concerns. Table II-1 presents the ways that each alternative responds to each of the issues and concerns. Since benchmarks are analytic bases rather than attempts to respond to all issues, they do not appear in this table.

Each Alternative has goals and output objectives. These are designed to respond to public issues and management concerns. Table II-1 presents the response of each Alternative to the issues and concerns which are addressed differently in each Alternative.

Narrative descriptions of each Alternative include a section on roads of issue. The issues relating to these four roads are briefly outlined below:

- Todd Lake-Three Creeks Lake, No. 460 0370. The question about standard of road is needed.
- Irish-Taylor, No. 463 0600. The question is whether to retain the road in its current primitive condition or to upgrade it.
- Waldo-Forest Road No. 5897. The question is whether to improve and develop a new major highway crossing the Cascade Crest or to maintain it at its current standard.
- Windigo Pass, No. 60. The road bisects the Oregon Cascade Recreation Area. The question is whether to retain it as a low-standard road or to upgrade it to some higher level.

The land adjustment program is keyed to the management areas. Even though it was not mapped for each Alternative, it is possible to portray it by reviewing the Alternative maps. For the most part, any area other than Management Area 8 would be retained in public ownership. Also, areas in Management Area 8 could be dropped from public ownership. It would be more practical to dispose of some of the isolated small parcels of land, regardless of the management areas in the Alternatives.

Table II-1 describes the issues and concerns which are associated with the various Alternatives. Figures IX, X, and XI illustrate the variations between selected key issues as shown by the amount of land distributed to the resources being emphasized.

Each Alternative addresses the potential for geothermal leasing. It must be recognized that leasing has already occurred on a significant portion of the Forest. This Draft EIS primarily deals with leasing in the Newberry Crater Known Geothermal Resource Area or applications received after the Final EIS and Forest Plan have been completed. The leasing already allowed was done through the Environmental Assessment process tied to the 1978 Land Management Plan. Most existing leases cannot be modified by the various Alternatives. The exception is, where leasing stipulations are restrictive based upon the 1978 Land Management Plan and

Table II-1 Comparison of Issue and Concern Resolution by Alternative

Issues and Concerns	Outputs or Effects To Be Measured	Alt. A Cur. Dir.)	Alt. B (RPA)	Alt. C	Alt. D	Alt. E (Pref.)	Alt. F	Alt. G	Alt. H
Local and Regional Economies, Lifestyles, and Population levels	N/A	Is in harmony with local and Regional economies & lifestyles in the short term.	Emphasizes mix of commodity and amenity. Maintains lifestyles near present conditions.	Emphasizes commodity outputs and growing economic conditions and possibly populations.	Emphasized recreation and visual while maintaining fairly high commodity outputs.	Emphasizes fairly high commodity outputs, primarily timber, in short term with mixed emphasis on commodity and amenity.	Emphasizes mix of commodity and amenity. Maintains lifestyles near present conditions.	Emphasizes amenity values with reduced emphasis on commodity values.	Emphasize amenity values while maintaining timber outputs near RPA levels.
Timber Harvest Level and Schedule	MMBF	Continue with current level.	Meets RPA 80 Program.	Increase to meet Forestry Program for Oregon and treat lodgepole.	Increase but on lands without high recreation, visual, & wildlife values.	Maintains a mix of products while accelerating harvest of lodgepole.	Small increase consistent with meeting a mix of multiple use objectives.	Harvest level will be determined based upon meeting goals for amenity values.	Harvest level will be established after meeting goals for amenity values. Departure may be necessary.
Management of LP & PP Stands Infested with MPB and susceptible to infestations on Deschutes, Fremont, Winema	Acres Treated and Timeframe	Limits amount of area treated. Extends treatment over a 40-year period.	Same as F.	Maximizes amount of area treated in a short time period (10 years).	Treats a large amount of area in a short time period (10 years).	Same as F.	Treats all but recreation and visual areas in short time period. Extends treatment period for these areas (10-20 years).	Extends treatment period over long time period (30 years).	Extends treatment over a 20-30 year period.
Future Demands for Use of Firewood	M Cords	No specific long term plans.	60,000 cords provided annually.	No special provisions for personal use firewood. All wood sold on competitive basis except slash.	Same as C.	Same as F.	Same as E. 60,000 cords annually.	75,000 cords annually or meet the demand.	Same as G.
Provision for Present and future Developed Rec.	MRVD's	Limits the potential.	Increases the potential.	Significantly increases the potential.	Significantly increases the potential.	Significantly increases the potential.	Significantly increases the potential.	Limits the potential.	Same as G.
Expanding Demands for Dispersed Recreation	MRVD's	Limits motorized. Maintains non-motorized.	Emphasizes a mix of motorized and non-motorized recreation.	Significantly increases motorized, reduces non-motorized.	Emphasizes motorized, de-emphasizes nonmotorized.	Emphasizes a mix of motorized and nonmotorized.	Same as E.	De-emphasizes motorized with heavy emphasis on non-motorized.	Same as G.
Goods and Services provided While Maintaining Visual Quality		Heavy emphasis on visual.	Moderate emphasis on visual in different areas.	Heavy emphasis on goods and services-little emphasis on visuals.	High emphasis on both visual and goods and services.	Same as B except visual emphasized in different areas.	Moderate emphasis on visual and goods and services.	Low emphasis on visual and goods and services.	Moderate emphasis on visual and goods and services.

Table II-1 Comparison of Issue and Concern Resolution by Alternative (continued)

Issues and Concerns	Outputs or Effects To Be Measured	Alt. A (Cur. Dir.)	Alt. B (RPA B)	Alt. C	Alt. D	Alt. E (Pref.)	Alt. F	Alt. G	Alt. H
Nonwilderness Roadless Areas		Mixed developed & not developed.	Same as F except there is a variation in the areas which remain undeveloped.	All developed.	Select areas remain undeveloped. Majority is developed.	Same as B with a different variation on what is developed.	Areas with high public concern remain undeveloped. Others are developed.	None of areas developed.	Majority of areas not developed.
How should the Forest identify and protect its cultural resources?		SEE STANDARDS AND GUIDELINES FOR ALL ALTERNATIVES							
T, E, and S Wildlife and Botanical Species Habitat	No. of Pairs	1978 Plan not amended to incorporate Recovery Plan goals. Spotted owl mgmt. areas provided.	Habitat provides bald eagle plan spotted owl mgmt. areas.	Bald Eagle Recovery Plan goals met. Spotted owl mgmt. areas provided.	Same as C.	Same as C.	Same as C.	Exceeds Recovery Plan goals. Provides for all spotted owl habitat.	Same as G.
Wildlife Population Levels		Maintains current levels.	Increases deer and eagles. Maintains others near current.	Maximizes deer - all others at minimum levels.	Maintains deer. Increases most others.	Same as F. except some species decrease more rapidly.	Increases deer. Maintains osprey. Increases eagles. Decreases some others.	Decreases deer while increasing some other species.	Same as G.
Level of old growth	% Old Growth	3%	5%	0	3%	5%	5%	10%	10%
Resources Planning Act Targets	MRVD's MMCF's MAUM's Ac. Equiv.	Below RPA.	Meets RPA	Exceeds RPA	Exceeds RPA goals but meets or exceeds others.	Below some RPA target but exceeds others.	Below some RPA goals but meets or exceeds others.	Will not meet RPA.	Meets some RPA goals but not others.
Areas Available for Geothermal Development	Acres by potential.	Does not address Newberry Crater.	Increases opportunity. Some sensitive areas available.	Maximizes leasing opportunity.	High levels of leasing opportunity in sensitive areas.	Increases opportunity except in certain sensitive areas.	Increase leasing opportunity except in sensitive areas.	Limits leasing opportunity to nonsensitive areas only.	Same as G.

Table II-1 Comparison of Issue and Concern Resolution by Alternative (continued)

Issues and Concerns	Outputs or Effects To Be Measured	Alt. A (Cur. Dir.A)	Alt. B (RPA B)	Alt. C	Alt. D	Alt. E (Pref.)	Alt. F	Alt. G	Alt. H
Should the Forest continue to use man-made chemicals.?		WOULD BE USED IN COMPLIANCE WITH REGIONAL POLICY							
How should the Forest menage its lakes, streams, and wetlands to prevent degradation?		SET STANDARDS AND GUIDELINES FOR ALL ALTERNATIVES							
To what extent should the Forest enhance or maintain soil productivity and control erosion?		SET STANDARDS AND GUIDELINES FOR ALL ALTERNATIVES							

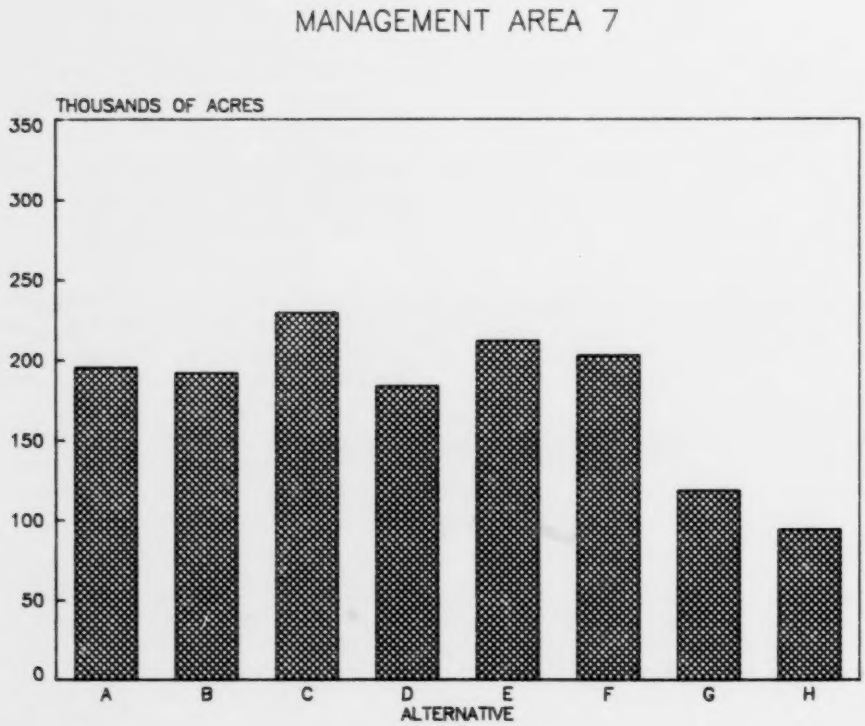
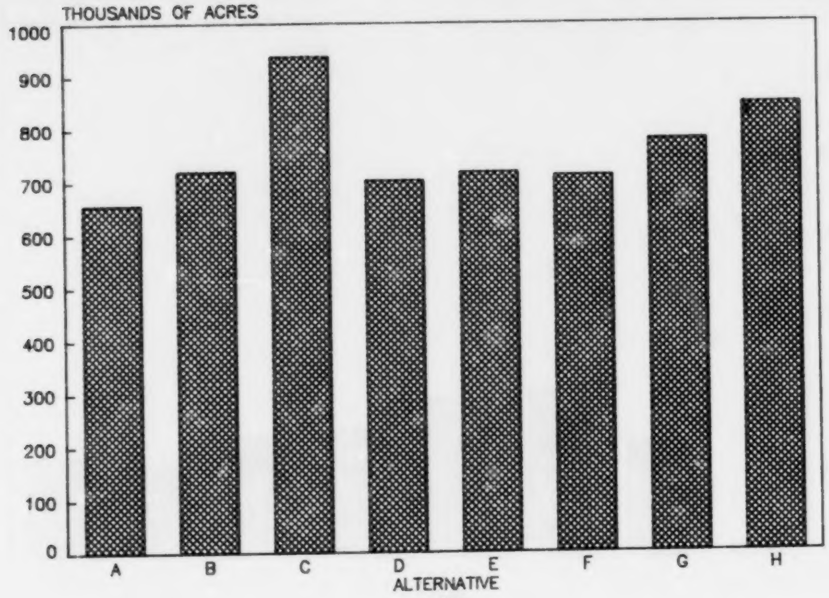


Figure IX

MANAGEMENT AREA 8



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MANAGEMENT AREA 9

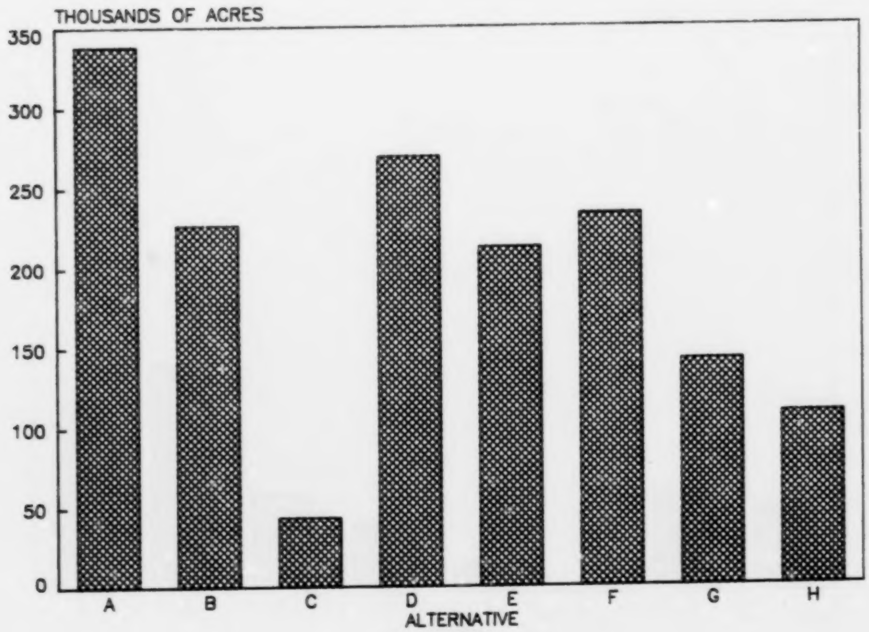

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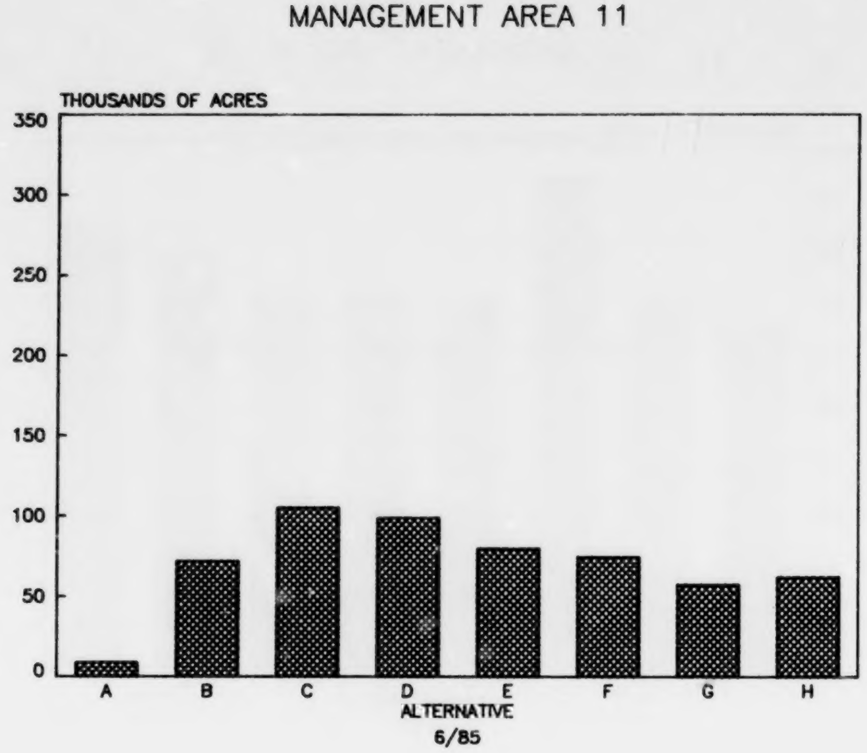
Figure X


MANAGEMENT AREA 11
THOUSANDS OF ACRES
350
300
250
200
150
100
50
0
A
B
C
D
E
F
G
H
ALTERNATIVE
6/85

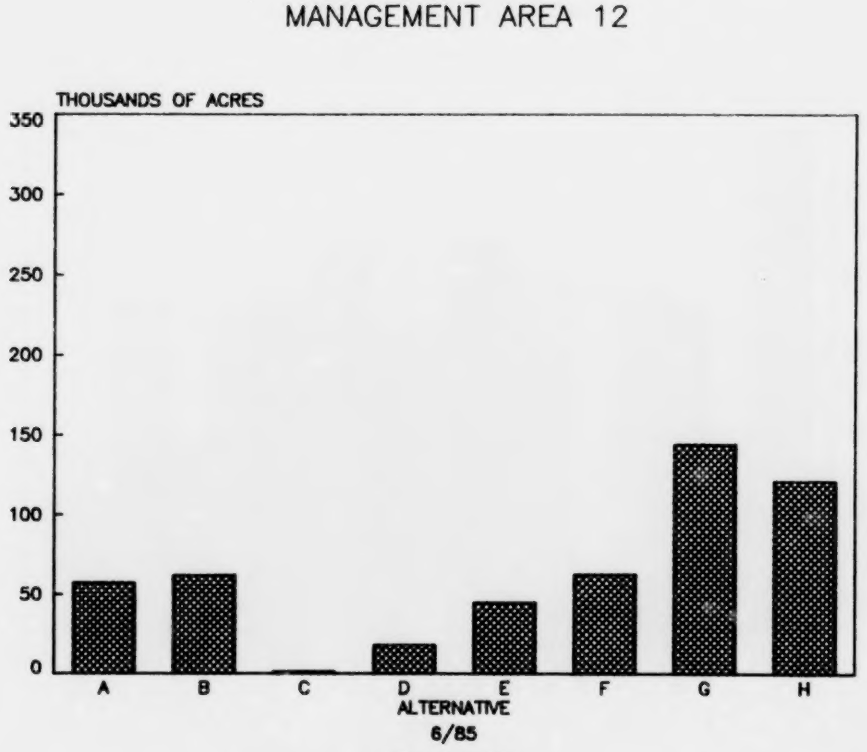

MANAGEMENT AREA 12
THOUSANDS OF ACRES
350
300
250
200
150
100
50
0
A
B
C
D
E
F
G
H
ALTERNATIVE
6/85

Figure XI

an Alternative proposes less restrictive land allocations. In these areas stipulations can be modified with the leassee's consent. Where the opposite may occur, more restrictive allocations over nonrestrictive leases, the stipulations cannot be changed unless the leassee is willing. Where leasing was denied, based upon the 1978 Plan, and an Alternative proposes that leasing would be compatible, if that Alternative were selected as the Preferred Alternative, then leases could be issued where they were denied under the 1978 Plan. Refer to Appendix G for a sample of kinds of leasing stipulations that have been used in the existing leases. The Alternatives discuss leasing potential but do not make specific recommendations regarding leasing. The specific decision regarding leasing of a specific area will be made through a subsequent Environmental Analysis process.

Management Areas

The Management Areas are subject to management according to Standards and Guidelines. One of the principal functions of these Standards and Guidelines is to ensure that potentially adverse environmental effects are mitigated and/or avoided. Some of these Standards and Guidelines were developed by the Interdisciplinary Team specifically to respond to environmental conditions on the Deschutes National Forest, others were adopted from the standards and guidelines in the Regional Guide.[1]

Each Alternative distributes the lands of the Forest to different Management Areas. The acres in the different Management Areas vary from one Alternative to another. These acres are presented in Table II-2. The land and resource management goals for each Management Area follow Table II-2. Figures XII and XIII show the percentage of acres occurring in each Management Area for each Alternative. The Management Areas for each Alternative are shown on the maps which accompany this DEIS.

Brief descriptions of each of the Management Areas follow. They are described by goal statement and desired future conditions. They are described here to aid in the understanding of the Alternatives.

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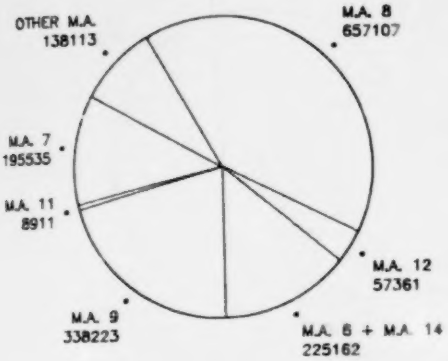
[1] Refer to Appendix D of this DEIS, to the Standards and Guidelines which are found in the Proposed Forest Plan, and to the more complete descriptions in the Proposed Forest Plan which contain direction for the enhancement, protection, and mitigation of resources.

TABLE II-2 Acreages in Management Areas By Alternative

Management Areas	(Current Direction) A	(RPA) B	C	D	(Preferred) E	F	G	H
1	39,717	18,805	13,440	18,907	19,243	18,043	15,781	16,298
2 (Research Natural Areas)	7,227	6,565	2,939	3,435	6,976	7,648	7,376	7,376
3	3,520	19,797	15,360	20,144	19,797	19,862	21,131	21,109
4	0	8,085	7,280	15,168	8,085	7,376	14,442	16,459
5	9,600	9,531	0	20,997	9,531	9,403	31,317	30,912
6 (Wilderness)	182,506	182,506	182,506	182,506	182,506	182,506	182,506	182,506
7	195,535	192,127	229,337	183,674	212,063	202,895	118,591	94,138
8	657,107	721,291	937,286	702,164	717,219	710,812	779,056	845,722
9	338,223	226,452	43,445	269,305	212,355	233,049	141,856	108,273
10 (Bend M. Watershed)	3,536	3,536	3,536	3,536	3,536	3,536	3,536	3,536
11	8,911	71,821	105,108	98,784	79,648	74,586	57,444	62,106
12	57,361	61,941	1,408	18,192	44,762	62,794	145,450	121,349
13	0	26,309	26,069	19,675	32,640	10,235	0	4,933
14 (Oregon Cascade Recreation Area)	42,656	42,656	42,656	42,656	42,656	42,656	42,656	42,656
15	29,106	18,948	0	11,227	19,353	24,969	49,228	52,997
16 (Experimental Forest)	10,042	10,042	10,042	10,042	10,042	10,042	10,042	10,042
Protection Management[1]	31,861							
Mining Claims[1]	3,504							
TOTAL	1,620,412	1,620,412	1,620,412	1,620,412	1,620,412	1,620,412	1,620,412	1,620,412

[1] Management options included in the 1978 Land Management Plan but which were not used as general strategies in developing the Alternatives.

ALTERNATIVE A
(acres/management area)



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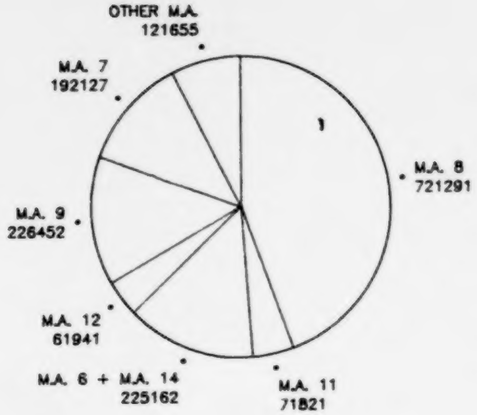
ALTERNATIVE B
(acres/management area)



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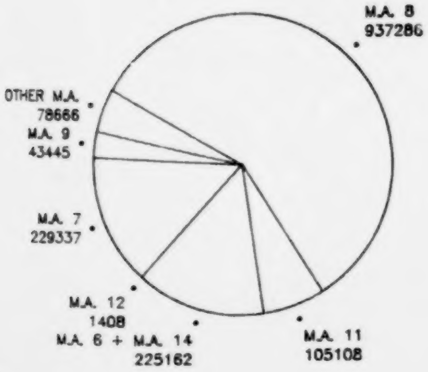
ALTERNATIVE C
(acres/management area)



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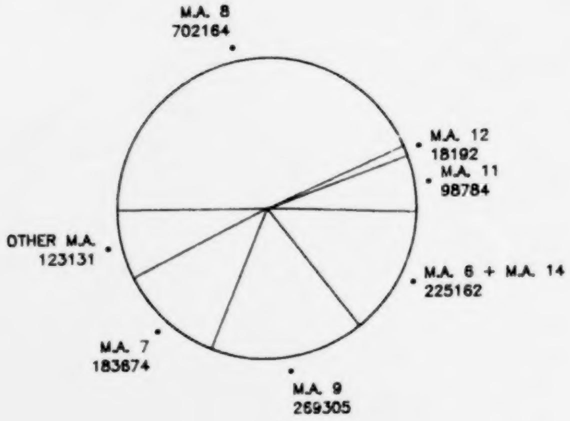
ALTERNATIVE D
(acres/management area)



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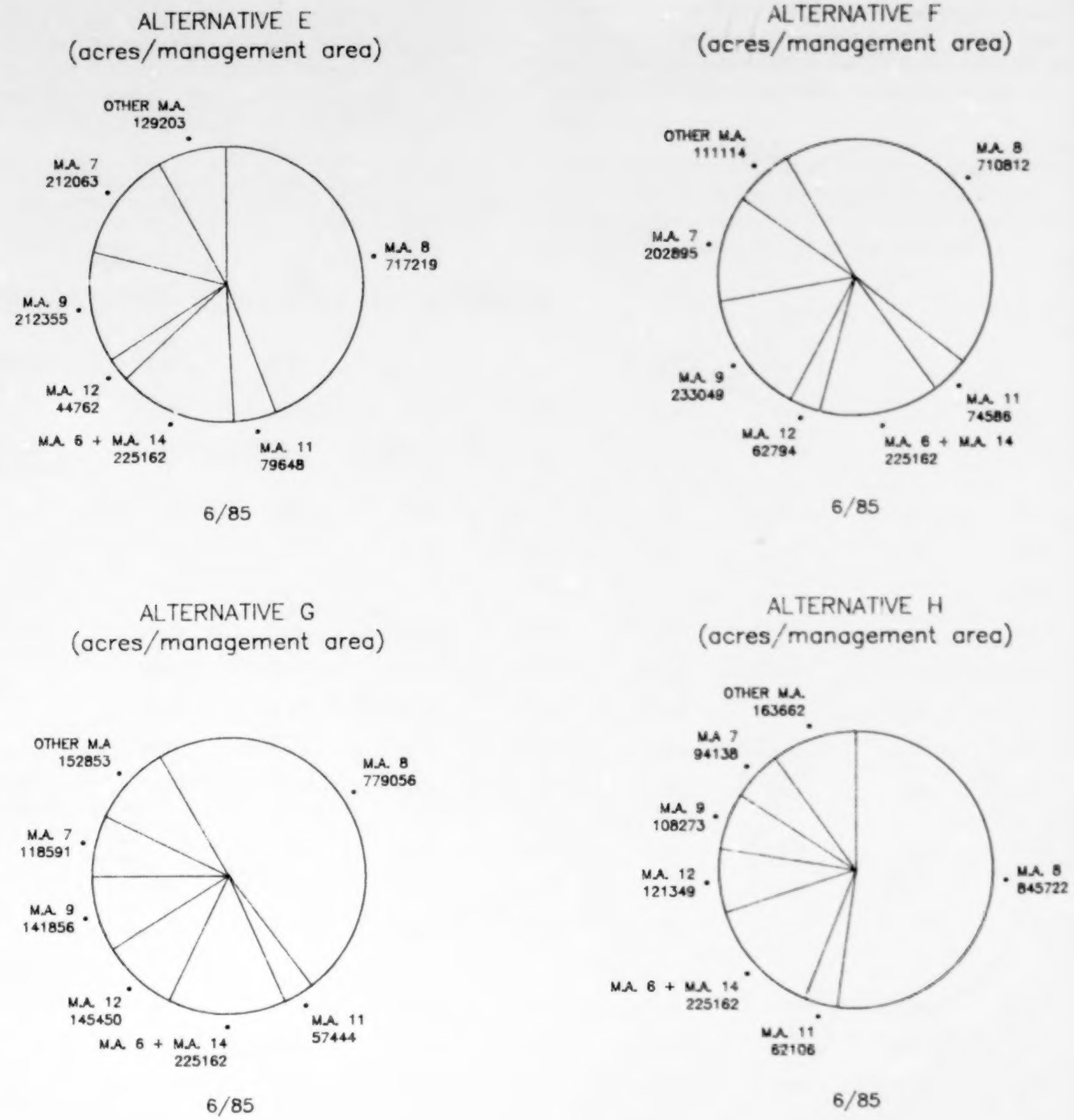

ALTERNATIVE E
(acres/management area)
OTHER M.A. 129203
M.A. 7 212063
M.A. 8 717219
M.A. 9 212355
M.A. 12 44762
M.A. 6 + M.A. 14 225162
M.A. 11 79648
6/85
ALTERNATIVE F
(acres/management area)
OTHER M.A. 111114
M.A. 8 710812
M.A. 7 202895
M.A. 9 233049
M.A. 11 74586
M.A. 12 62794
M.A. 6 + M.A. 14 225162
6/85
ALTERNATIVE G
(acres/management area)
OTHER M.A 152853
M.A. 8 779056
M.A. 7 118591
M.A. 9 141856
M.A. 12 145450
M.A. 6 + M.A. 14 225162
M.A. 11 57444
6/85
ALTERNATIVE H
(acres/management area)
OTHER M.A. 163662
M.A 7 94138
M.A. 9 108273
M.A. 12 121349
M.A. 8 845722
M.A. 6 + M.A. 14 225162
M.A. 11 62106
6/85

Figure XIII

Management Area 1

To preserve and provide interpretations of unique geological, biological, zoological, and cultural areas for education, scientific, and public enjoyment purposes.

Unusual geological or biological sites and areas are preserved and managed for education, research, and to protect their unique character. Facilities and opportunities may be provided for public interpretation and enjoyment of the unique values of these sites and areas. The primary benefiting uses of these areas will be for developed and dispersed recreation, research, and educational opportunities. These areas will be designated by Regional Forester authority.

Management Area 1

Figure XIV

Management Area 2 (Research Natural Areas)

To preserve examples of naturally occurring ecosystems in an unmodified condition for research and education.

In Research Natural Areas (RNA's), natural features are preserved for scientific purposes and natural processes are allowed to dominate. The purpose of Research Natural Areas is to provide:

- Baseline areas against which effects of human activities can be measured.
- Sites for study of natural processes in undisturbed ecosystems.
- Gene pool preserves for all types of organisms.

Forest-type RNA's will preferably be old-growth or virgin stands and offer the best available site or growing conditions for a given tree species. When old-growth stands or optimum sites are not available, younger age classes or less productive sites may be an acceptable substitute. Nonforested type RNA's will be sites with good to excellent range conditions.

Management Areas 3-4-5

To protect and manage habitat to provide for the perpetuation of bald eagles, northern spotted owls, and osprey.

Habitat will be managed for bald eagles, northern spotted owls, and osprey. Nesting habitat and foraging areas will be protected and enhanced. Suitable nesting sites will be provided on a continuing basis. Old-growth stands with large trees will be emphasized for bald eagles and northern spotted owls. Osprey habitat will contain numerous trees and snags suitable for nesting. Stands will be managed so that suitable nesting sites are available on a continuing basis and spaced to minimize territorial competition. Human disturbance will be minimal during the nesting season.

Management Areas 3 and 4

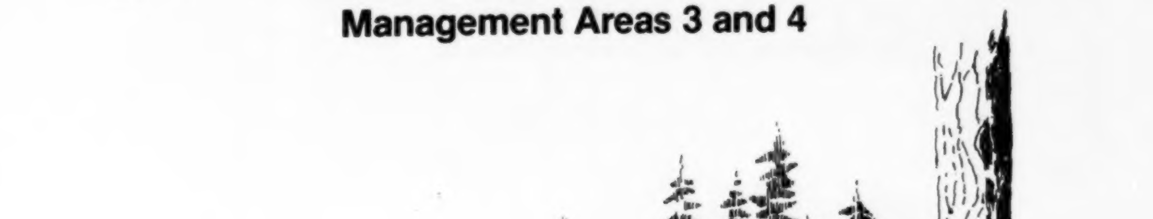


Figure XV

Management Area 6 (Wilderness)

To preserve the benefits of Wilderness values for the public, in accordance with the Wilderness Act of 1964.

Wilderness areas will provide environments that are:

- Essentially unaltered and undisturbed by humans.
- Primeval in character.
- Places where natural ecological processes (including the natural role of fire) can operate with a minimum of interference by humans.

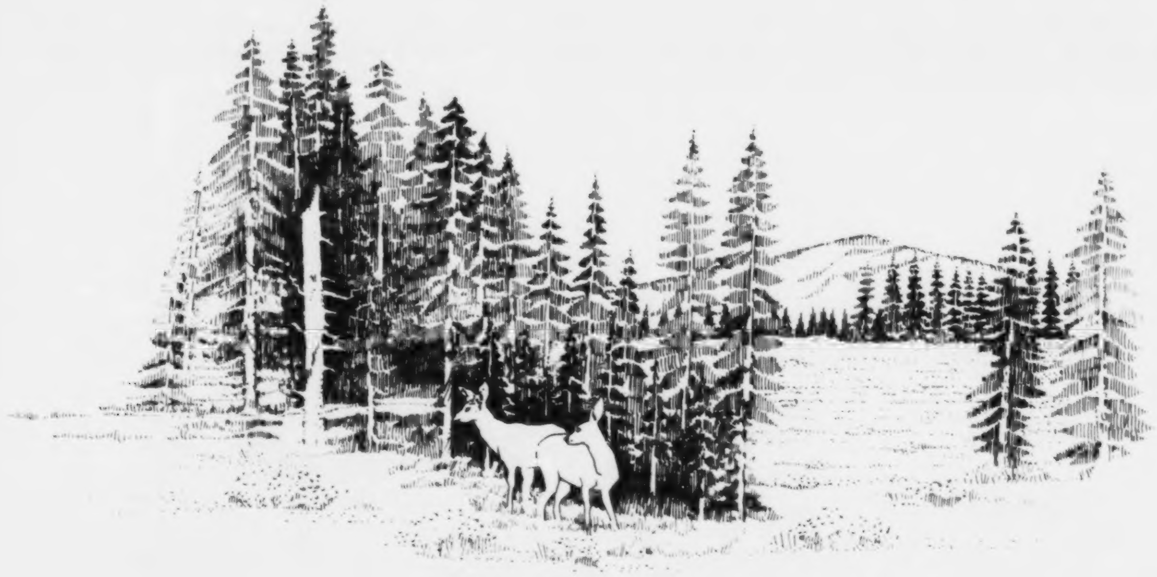
The Deschutes National Forest manages the eastern portions of the Mt. Jefferson, Mt. Washington, Three Sisters, and Diamond Peak Wildernesses, and the northern portion of the Mt. Thielsen Wilderness. Management jurisdiction of the remaining portions of these wilderness areas is held by the Willamette, Mt. Hood, Umpqua, and Winema National Forests.

Management Area 7

To manage vegetation to provide optimum habitat conditions on deer transition ranges while providing for domestic livestock forage and wood products.

Vegetation will be managed to provide optimum habitat. Herbaceous vegetation will be managed to provide a vigorous forage base with a variety of forage species available. Forage conditions will be improved where conditions are poor. Foraging areas will be created where forage is lacking. Cover will be developed where lacking, maintained when in proper balance, or reduced when overabundant and more foraging areas are needed.

Livestock grazing, both sheep and cattle, will be permitted with associated range improvements such as fences and water developments.



Management Area 7

Figure XVI

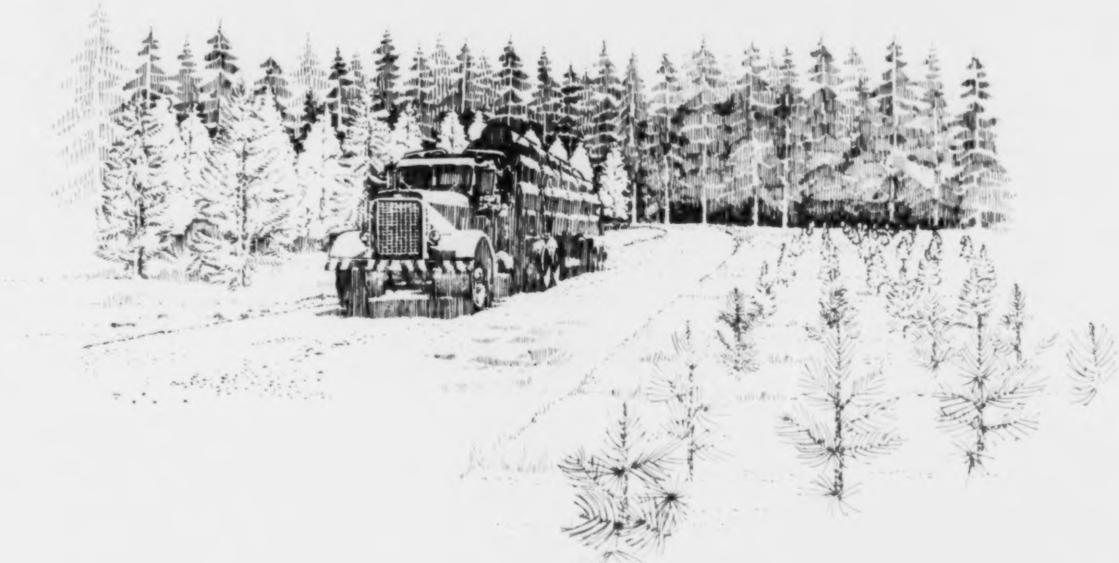
Management Area 8

To provide optimum and sustainable levels of timber while providing forage production and opportunities for public use and enjoyment.

Lands within this Management Area contain broad categories differing by the inherent capability and suitability to produce commercial quantities of timber and available forage.

Forage within this Management Area will be available for use by cattle, sheep, and big game. Some lands have no available forage so there will be no grazing. On other lands there will be need for coordination between timber and range management. On some areas grazing will be an emphasized use. Range structural improvements such as fences and water troughs may be constructed and maintained to meet range and timber management objectives. Range improvement projects such as prescribed burning or seeding may be utilized to improve the forage base.

The objective of timber management in this Management Area is to continue to convert unmanaged stands to managed stands. The aim of a managed forest is to have stands in a variety of age classes with all stands utilizing the site growth potential. This is achieved through stand treatments which include (but are not limited to) controlling stocking levels; maintaining satisfactory growth rates; protecting stands from insects, disease, and damage; controlling species composition; and regenerating stands that are no longer capable of optimum growth performance.



Management Area 8

Figure XVII

Management Area 9

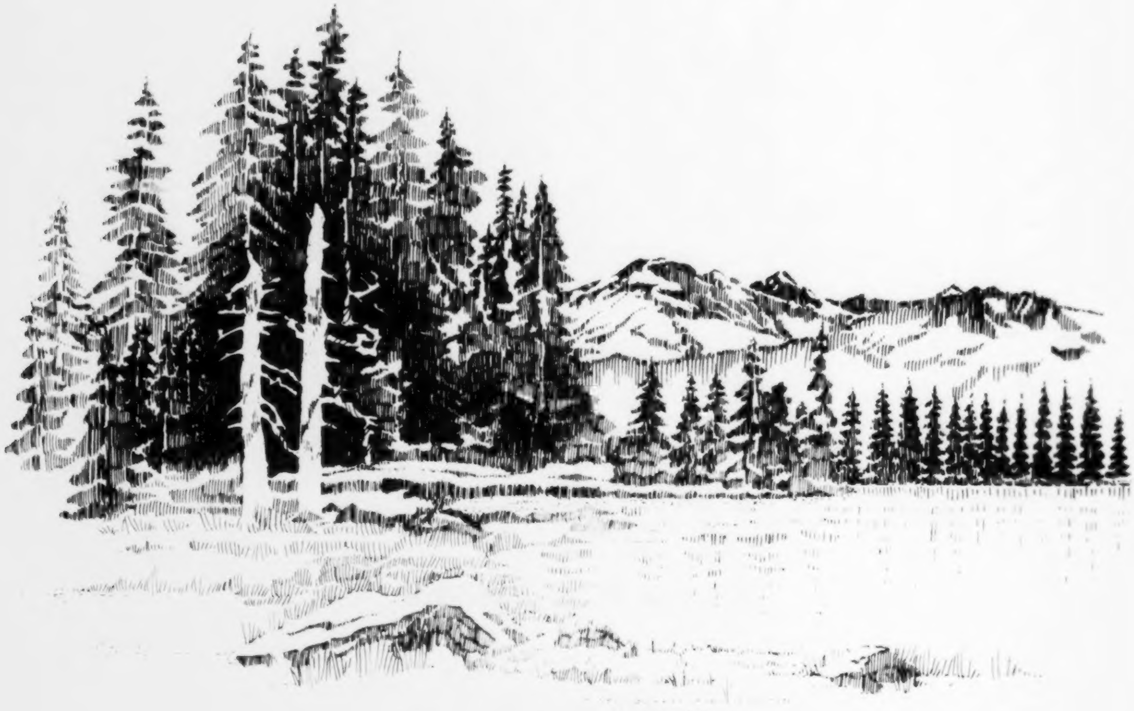
To provide Forest visitors with visually appealing scenery.

Landscapes seen from selected travel routes and use areas will be managed to maintain or enhance their appearance. To the casual observer, results of activities either will not be evident or will be visually subordinate to the natural landscape.

Landscapes will be enhanced by opening views to distant peaks, unique rock forms, unusual vegetation, or other features of interest. Timber harvest is permitted, but only to protect and improve the visual quality of the stands both now and in the future. Timber stands, which have remained unmanaged in the past because of their visual sensitivity, will begin receiving treatment to avoid loss of the stand to natural causes. Landscapes containing negative visual elements, such as skid roads, activity residue, or cable corridors, will be rehabilitated.

The desired condition for ponderosa pine is to achieve and maintain visual diversity through variations of stand densities and size classes. Large, old-growth pine will remain an important constituent, with individual specimen trees achieving 30 inches in diameter and having deeply furrowed, yellowbark characteristics.

For other species, the desired condition requires obtaining visual variety through either spatial distribution of age classes and species mixes, through density manipulation, or through a mixture of age classes within a stand.



Management Area 9

Figure XVIII

Management Area 10 (Bend Watershed)

To provide water at a level of quantity and quality which will, with adequate treatment, result in a satisfactory and safe domestic water supply.

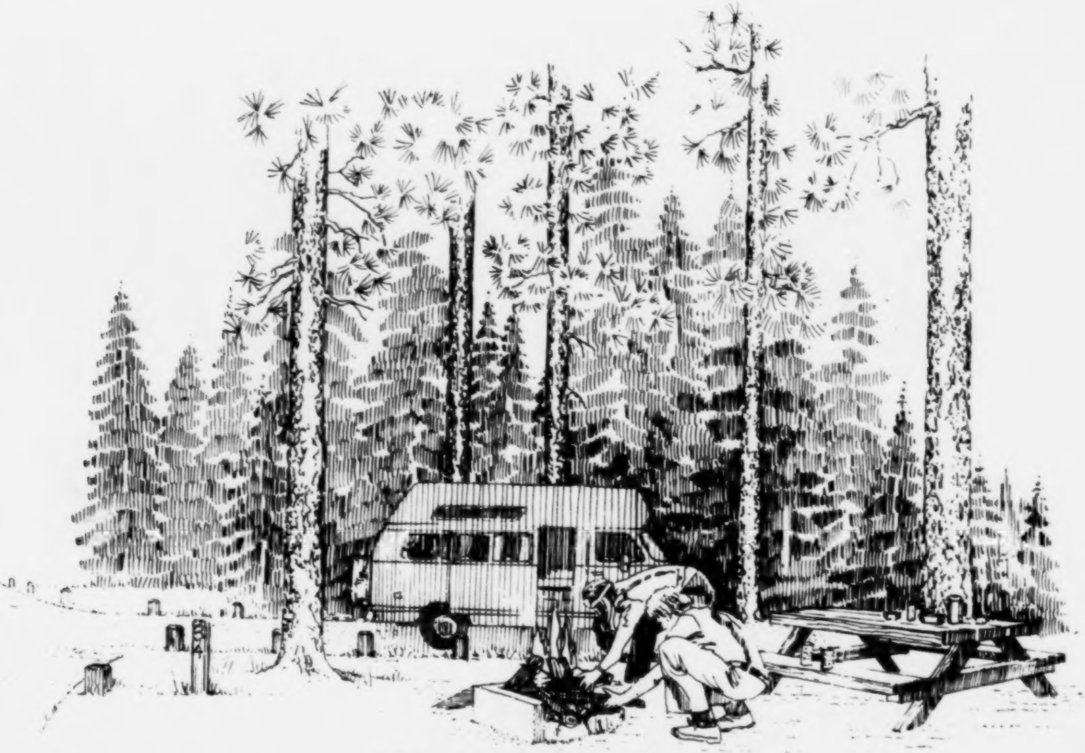
The Bend Municipal Watershed will be managed to provide healthy timber stands that are growing at a moderate rate. Stands will be in a condition which provides a minimum threat for catastrophic fire and which will retard insect infestation. Existing water quality will be maintained. Stream channels will be in stable conditions throughout the watershed. Access into the watershed for administrative and dispersed recreational activities will be allowed at a level which is compatible with the water quality goals of the Management Area.

Management Area 11

To provide a full range of quality outdoor recreation opportunities within a forest environment that can be modified for visitor use and satisfaction or to accommodate large numbers of visitors.

This Management Area will provide a wide variety of recreation opportunities including, but not limited to, activities dependent on various intensities of development. Sophisticated facilities and sights and sounds of human's will be evident and often essential to provide the desired recreation experience. Generally, high concentrations of visitors will occur around developments. Fewer numbers will occur outside developments, but encounters between visitors can be frequent. Visitors with little knowledge of outdoor skills will be able to enjoy the area.

Opportunities for participation in a broad range of outdoor recreation activities will be available. Activities will often require support facilities and often, but not always, involve widespread use of motorized vehicles and boats.



Management Area 11

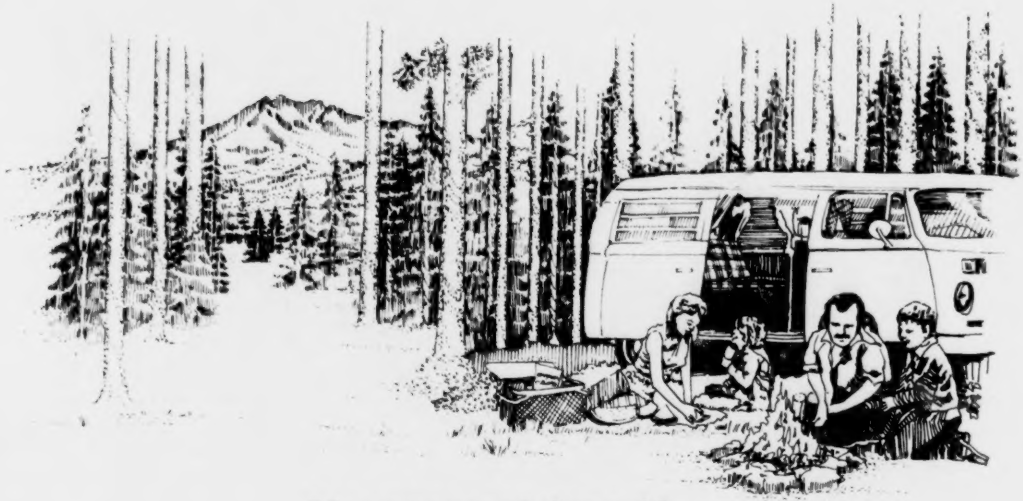
Figure XIX

Management Area 12

To provide a range of quality recreation opportunities in an undeveloped forest environment.

This Management Area will provide an environmental setting producing the kinds of recreation experiences that are attainable in large undeveloped areas. It will provide a feeling of vastness and remoteness and will have no irreversible evidence of humans. It will be in a predominantly unmodified or natural state. The environmental setting will often include a wide diversification of vegetation, terrain, and visible landform.

It will be managed to provide limited social contact and interaction among visitors. Primitive facilities, such as shelters and small camps, signing, and a transportation system for visitor access and use may be established. Management will provide recreation opportunities that occur in a primitive environment, but restrictions will be less than in Wilderness areas. Motorized activities could be permitted in some areas. Low-standard roads and trails could be utilized for motorized activities.



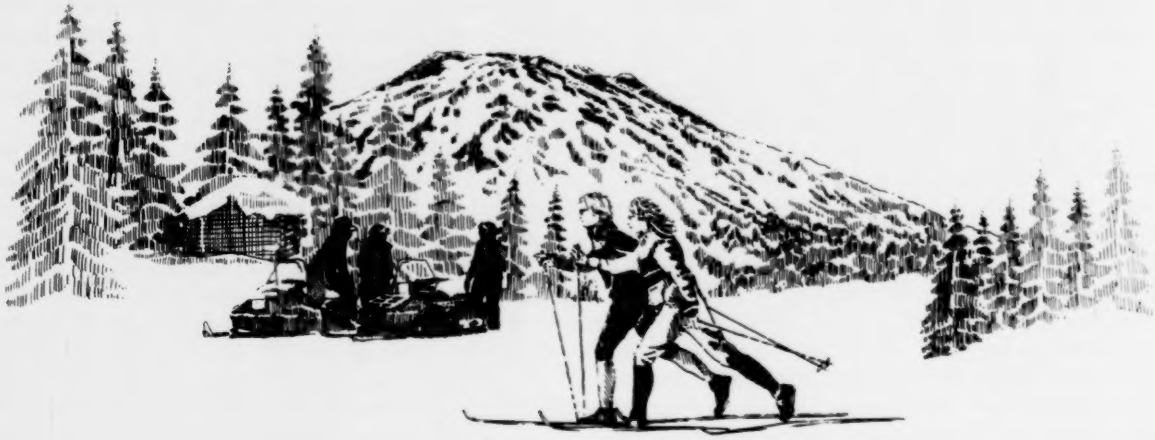
Management Area 12

Figure XX

Management Area 13

To provide quality winter recreation opportunities within a forest environment that can be modified for visitor use and satisfaction.

This Management Area will provide opportunities for winter recreation activities. Facilities and evidence of man will be present. Roads, vegetation management, and other development activities are permitted but only as necessary to enhance the winter recreation opportunities. Social contact will vary but high social contact could be expected in some areas and during some portions of the winter use season. Facilities for tubing and sledding can be developed. Some areas will be closed to motorized use. This area is available for geothermal leasing.



Management Area 13

Figure XXI

Management Area 14 (Oregon Cascade Recreation Area)

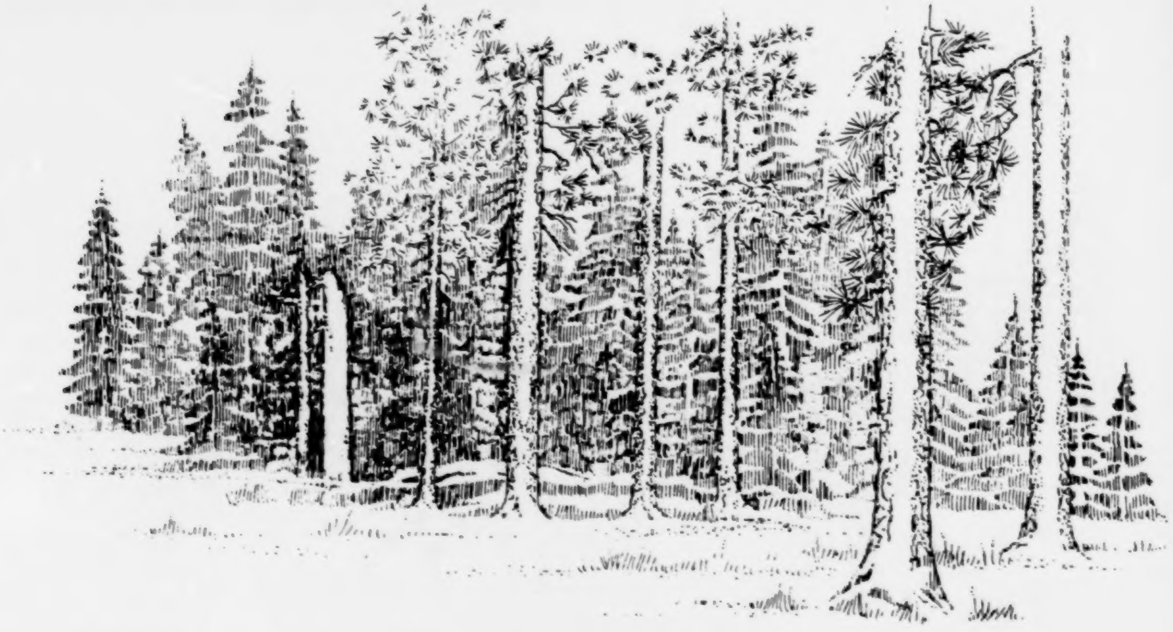
To conserve, protect, and manage, in a substantially unmodified condition, areas for their unique character and values.

Provide opportunity to enjoy scenic, wildlife, and recreation values in a setting that is not dominated by human activities but where some motorized use could be permitted along with some recreation related facilities.

Management Area 15

To provide old-growth tree stands for (1) preservation of natural genetic pools, (2) habitat for plants and wildlife species associated with overmature tree stands, and (3) contributions to the diversity spectrum.

Vegetation will be managed to provide mature or overmature tree stands having large trees, snags, dead downed material, and in many cases, two or more canopy levels. Such stands would vary in size and be located so that a wide variety of conditions are represented. Other Management Areas will also provide old growth.



Management Area 15

Figure XXII

Management Area 16 (Experimental Forest)

To provide an area where field research activities are conducted while considering other resource values.

The Pringle Falls Experimental Forest is within the Forest boundary and is administered by the Pacific Northwest Forest and Range Experiment Station. The Experimental Forest serves as a field laboratory for research. Experiments are conducted to evaluate the effects of silvicultural practices on growths and yield of ponderosa and lodgepole pine. The effects of harvesting on soil moisture and other resources are also being evaluated. The role of fire in natural ecosystems is being investigated.

Resource Outputs, Environmental Effects, Activities, and Costs

The implementation of any one of the alternatives will result in the production of certain outputs and effects and their associated environmental consequences. Some of the consequences are direct while others are indirect. Some of the consequences are short term while others are cumulative or long term. Chapter IV presents a detailed discussion of the general inter-relationships between the outputs and effects and their associated environmental consequences. In the following section of Chapter II, the specific outputs and effects for each alternative are presented for comparison purposes. Much of the analysis performed to develop these outputs and effects is quite complex and is described in detail in Appendix B. Therefore, in order to fully understand the environmental consequences associated with each alternative and their derivation, we recommend reading Chapters II and IV and Appendix B.

The following four tables (II-3a, II-3b, II-3c, and II-3d) present the direct, indirect, and cumulative resource outputs and effects associated with each alternative and certain selected benchmarks. By examining Table II-1 (Comparison of Issue and Concern Resolution by Alternative) in conjunction with these tables, a better understanding of the relationship between issue resolution and the resulting outputs and effects for each alternative can be obtained. While many of the following displays are self explanatory, to facilitate the reading and understanding of these tables and other portions of this document, it may be necessary to refer to the Glossary for definitions and explanations of abbreviations and units of measure.

Table II-3a displays the average annual quantifiable resource outputs and effects by alternative. The table is quite comprehensive and will be referred to time and again throughout the remainder of this document. The figures following Table II-3a help to graphically summarize some of the information in this table which pertains to key issues.

Most of the outputs and effects for each alternative are displayed for the years 1986, 2000, and 2030. These can be interpreted as the average annual outputs for the decadal planning periods they represent. The year 1986 is the first year of the first decade of the plan (1986-1995). The year 2000 is the mid-point of the second decade (1996-2005), and 2030 is the mid-point of the fifth decade (2026-2035). These years are displayed for their coverage of both short and long-term outputs and effects. Also, a Forest Plan for any of the alternatives is 10-15 years so the outputs and effects for the fifth decade are potential outputs and effects if the alternative were continued beyond the life of the Plan and into the future.

Note that the output levels for some resources during the first two time periods are similar across all of the alternatives. This makes it appear as though there is no difference between the alternatives. However, there usually is. The Developed Recreation outputs at the top of the table are a good example for this discussion. The consumption levels across all alternatives during 1986 vary from 1393 MRVDs for Alternative A to 1430 MRVDs for Alternative C, a relatively narrow range. However, there is quite a wide range of differences between these Alternatives in the amount and location of lands managed for recreation purposes (Refer to Table II-2). The future projections of recreation use for each alternative are based largely on the projected population levels for the State of Oregon and its resulting effects on demand for recreation use on the Forest. Consequently, the short term differences in the amount of recreation use between the Alternatives is relatively small. The differences become greater over time as the different carrying capacities and recreation emphases between the Alternatives begin to affect the recreation use levels and patterns on the Forest. In essence, many of the consequences resulting from decisions made in the alternatives will not be apparent in the short-term, but will become more noticeable in the longrun outputs and effects. The same is true for the projections of range use and wildlife population changes where response to land use management decisions is often more gradual than abrupt.

Many of the outputs and effects that would result from the implementation of an alternative can not be easily expressed in quantitative terms. For these cases, qualitative statements are necessary to summarize the respective consequences of each alternative. Table II-3b compare the qualitative outputs and effects associated with each of the Alternatives.

Table II-3a Average Quantifiable Resource Outputs and Environmental Effects by Alternative

Outputs/Effects	Unit of Measure	Cur.Dir. (A)	RPA (B)	C	D	Preferred (E)	F	G	H
Developed Recreation Use	MRVD's[1]								
1986 (Planned)		1393	1421	1430	1421	1421	1421	1408	1421
2000 (Potential)		1495	1725	1811	1726	1727	1725	1662	1719
2030 (Potential)		1837	2567	3493	2983	2770	2638	2045	2310
Non-Wilderness Dispersed Recreation Use:									
Roaded	MVRD's								
1986 (Planned)		1402	1417	1434	1417	1416	1416	1430	1416
2000 (Potential)		1576	1680	1747	1697	1688	1678	1616	1637
2030 (Potential)		1572	1922	2340	2154	2029	1954	1687	1756
Unroaded									
1986 (Planned)		132	132	81	132	132	132	135	132
2000 (Potential)		161	151	98	149	161	151	172	161
2030 (Potential)		293	293	175	226	293	293	356	293
Wilderness Use	MRVD's								
1986 (Planned)		77	77	77	77	77	77	79	77
2000 (Potential)		94	94	94	94	94	94	101	94
2030 (Potential)		171	171	171	171	171	171	212	171
Trail Construction/ Reconstruction	Miles								
1986 (Planned)		5	5	0	10	5	5	10	10
2000 (Potential)		5	5	0	10	5	5	10	10
2030 (Potential)		5	5	0	10	5	5	10	10
Developed Site Construction/ Reconstruction	CG Units[2]								
1986 (Planned)		75	65	75	0	65	65	0	0
2000 (Potential)		75	65	75	0	65	65	0	0
2030 (Potential)		75	65	75	0	65	65	0	0
Visual Quality Objectives:									
Preservation	Acres								
1986 (Planned)		232,389	231,727	228,101	228,587	232,137	232,810	232,538	232,538
Retention	Acres								
1986 (Planned)		222,541	160,030	28,693	111,646	126,462	162,451	240,421	233,811
Partial Retention	Acres								
1986 (Planned)		179,273	204,998	178,724	246,937	218,090	197,649	185,558	178,073
Modification/Max. Mod.	Acres								
1986 (Planned)		986,209	1,023,657	1,184,894	1,033,206	1,043,722	1,027,502	961,895	975,990
Unroaded Areas Assigned to Roaded Management Prescriptions, But Which Have No Development Activities Planned for the Next 15 Years or Until Plan is Revised.	Acres	144,925	128,348	101,764	130,439	121,248	134,842	145,142	139,532
Unroaded Acres Assigned to Unroaded Management Prescriptions	Acres	65,270	59,668	5,424	20,986	45,054	61,793	123,437	104,459

Table II-3a Average Quantifiable Resource Outputs and Environmental Effects by Alternative (continued)

Outputs/Effects	Unit of Measure	(Cur.Dir.) A	(RPA) B	C	D	(Preferred) E	F	G	H
Wildlife and Fish Use	M WFUD's³								
1986 (Planned)		22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2
2000 (Potential)		30.2	30.1	31.5	29.7	30.8	30.5	27.3	26.3
2030 (Potential)		54.3	52.2	54.7	51.6	53.5	52.9	47.1	45.4
Management Indicator Species:									
Bald Eagles	Pairs								
1986 (Planned)		20	20	20	20	20	20	20	20
2000 (Potential)		20	20	20	20	20[1]	20	20	20
2030 (Potential)		20	45	45	45	45	45	50	45
Northern Spotted Owls	Pairs								
1986 (Planned)		10	10	10	10	10	10	10	10
2000 (Potential)		10	10	10	12	10	10	12	12
2030 (Potential)		10	10	10	12	10	10	12	12
Osprey	Pairs								
1986 (Planned)		125	125	125	125	125	125	125	125
2000 (Potential)		140	125	125	140	125	125	125	140
2030 (Potential)		180	80	80	150	80	80	180	180
Goshawk	Pairs								
1986 (Planned)		120	120	120	120	120	120	120	120
2000 (Potential)		150	75	70	85	85	85	95	85
2030 (Potential)		65	65	50	50	65	65	80	60
Northern 3-Toed Woodpecker	Pairs								
1986 (Planned)		2440	2440	2440	2440	2440	2440	2440	2440
2000 (Potential)		2110	1040	780	1020	1020	905	1670	1045
2030 (Potential)		1215	1465	1120	1445	1440	1270	1625	1060
Pine Martin	Pairs								
1986 (Planned)		1550	1550	1550	1550	1550	1550	1550	1550
2000 (Potential)		1350	1295	1070	1295	1285	1225	1470	1020
2030 (Potential)		975	1390	970	1465	1330	1220	1385	1035
Mule Deer	Numbers								
1986 (Planned)		20,300	20,300	20,300	20,300	20,300	20,300	20,300	20,300
2000 (Potential)		20,300	23,300	23,300	23,300	23,300	23,300	16,700	15,200
2030 (Potential)		20,300	28,600	32,300	29,800	25,900	27,100	16,700	13,300
Elk	Numbers								
1986 (Planned)		1500 for all Alternatives. The Deschutes is the primary summer range for elk. Winter habitat, which is limiting to population size is not present.							
Woodpeckers	% of Potential Population	60%	60%	20%	60%	60%	60%	80%	80%
Resident Trout	See Explanation	Limited data available on fish habitat. Habitat conditions generally good. Standards and Guidelines developed to protect fish habitat.							
Wolverine and Peregrine Falcon	See Explanation	Occasional sightings of these species. Standards and Guidelines developed to address habitat if species are confirmed to be present.							
Great Blue Heron	See Explanation	Approximately 100 pairs are present. Rookeries (nest trees) are protected by Standards and Guidelines.							

Table II-3a Average Quantifiable Resource Outputs and Environmental Effects by Alternative (continued)

Outputs/Effects	Unit of Measure	Cur.Dir. (A)	RPA (B)	C	D	Preferred (E)	F	G	H
Wildlife Habitat Improv.	Acre Equivalents								
1986 (Planned)		6.2	6.4	30.0	23.5	27.0	26.0	16.0	12.5
2000 (Potential)		6.2	4.4	30.0	23.5	27.0	26.0	16.0	12.5
2030 (Potential)		6.2	2.7	30.0	23.5	27.0	26.0	16.0	12.5
Range - Permitted Grazing	MAUM's[4]								
1986 (Planned)		29	32	45	29	32	32	26	32
2000 (Potential)		29	36	45	29	36	32	26	36
2030 (Potential)		29	45	45	29	45	32	26	45
Timber Offered:	Million BF[5]								
Chargeable									
1986 (Planned)		190	174	265	171	202	174	153	187
2000 (Potential)		165	203	263	200	209	178	154	177
2030 (Potential)		230	225	247	225	228	216	181	197
Nonchargeable									
1986 (Planned)		15	22	25	22	23	21	20	25
2000 (Potential)		19	19	21	19	20	19	19	24
2030 (Potential)		16	21	22	22	22	20	20	28
Total									
1986 (Planned)		205	196	290	193	225	195	173	212
2000 (Potential)		184	222	284	219	229	197	173	201
2030 (Potential)		246	246	269	247	250	236	201	225
Timber Offered:	Million CF[6]								
Chargeable									
1986 (Planned)		39.6	42.0	59.8	41.3	46.6	39.2	32.5	41.7
2000 (Potential)		40.7	42.0	53.8	41.3	44.3	39.2	32.5	40.7
2030 (Potential)		40.7	41.9	45.4	41.3	41.9	39.2	32.5	40.7
Nonchargeable									
1986 (Planned)		3.2	4.7	5.4	4.8	5.0	4.5	4.3	5.4
2000 (Potential)		4.0	4.0	4.4	4.2	4.3	4.2	3.6	5.2
2030 (Potential)		3.5	4.5	4.7	4.7	4.8	4.3	4.3	6.3
Total									
1986 (Planned)		42.8	46.7	65.2	46.1	51.6	43.7	36.8	47.1
2000 (Potential)		44.7	46.0	58.2	45.5	48.6	43.4	36.1	45.9
2030 (Potential)		44.2	46.4	50.1	46.0	46.7	43.5	36.8	47.0
Chargeable Timber Offered by Working Group Mix:	Million CF								
Ponderosa Pine									
1986 (Planned)		16.8	15.7	18.6	13.6	15.1	16.0	17.6	17.7
2000 (Potential)		4.9	8.7	15.7	11.4	12.8	6.0	8.7	10.7
2030 (Potential)		16.4	22.5	17.7	20.6	21.3	17.3	15.4	20.8
Lodgepole Pine									
1986 (Planned)		11.5	23.4	16.9	23.5	22.9	16.9	9.6	16.1
2000 (Potential)		28.3	16.3	19.1	14.8	18.4	20.4	11.3	21.5
2030 (Potential)		0.3	0.2	0.1	0.2	0.2	0.2	0	3.7
Mixed Conifer									
1986 (Planned)		11.3	3.0	14.2	4.1	8.5	6.3	5.3	7.9
2000 (Potential)		7.4	17.1	19.0	15.1	12.4	12.8	12.5	8.5
2030 (Potential)		23.9	17.1	17.6	16.4	17.4	20.2	16.6	15.5

Table II-3a Average Quantifiable Resource Outputs and Environmental Effects by Alternative (continued)

Outputs/Effects	Unit of Measure	Cur.Dir. (A)	RPA (B)	C	D	Preferred (E)	F	G	H
Mountain Hemlock									
1986 (Planned)		--	--	--	--	--	--	--	0
2000 (Potential)		--	--	--	--	0.7	--	--	--
2030 (Potential)		--	2.1	10.0	4.1	3.0	1.5	0.5	0.8
Personal Use Fuel Wood	M Cords	60	60	?	?	60	60	75	75
Reforestation	M Acres/yr								
1986 (Planned)		9.3	15.1	19.4	15.1	16.1	12.0	7.8	12.1
2000 (Potential)		16.5	10.2	12.3	10.1	11.3	12.8	8.6	12.2
2030 (Potential)		8.7	10.3	10.3	9.0	10.4	9.2	7.1	9.9
Timber Stand Improvement	M Acres/yr								
1986 (Planned)		11.2	13.4	13.3	12.2	13.0	13.3	12.4	15.5
2000 (Potential)		7.9	7.2	10.6	8.8	9.7	6.3	6.5	14.7
2030 (Potential)		13.8	12.5	15.0	11.7	14.8	11.5	15.3	15.1
Long-Run Sustained Yield	Million CF	406	408	454	413	395	392	325	363
Timber Growth In 2030	Million CF	366	398	535	406	431	390	326	376
Reforestation Backlog	Acres								
1986 (Planned)		0	0	0	0	0	0	0	0
2000 (Potential)		0	0	0	0	0	0	0	0
2030 (Potential)		0	0	0	0	0	0	0	0
Reforestation Backlog	Dollars								
1986 (Planned)		0	0	0	0	0	0	0	0
2000 (Potential)		0	0	0	0	0	0	0	0
2030 (Potential)		0	0	0	0	0	0	0	0
Water Yield	M Acre Feet								
1986 (Planned)		2.2	3.1	4.2	3.1	3.9	2.6	1.7	2.6
2000 (Potential)		3.4	2.7	2.9	2.4	2.6	2.9	2.1	2.6
2030 (Potential)		2.2	2.6	2.6	2.4	2.5	2.3	1.8	2.3
Soil	Risk Index								
1986 (Planned)		9.0	14.7	20.7	14.4	15.0	12.7	10.2	13.4
2000 (Potential)		13.9	10.5	13.5	10.4	11.0	11.0	9.4	12.7
2030 (Potential)		45.2	10.6	10.4	10.7	10.5	57.1	8.6	14.1
Potential Geothermal Leasing	M Acres								
High Potential		85.9	91.5	126.1	105.0	100.0	80.3	52.8	62.8
Moderate Potential		484.0	461.0	486.5	483.1	468.8	461.0	436.3	444.2
Low Potential		402.4	400.1	410.0	410.0	400.1	402.8	399.4	400.0
Fire Management Effectiveness Index	$/M Protected Acres								
1986 (Planned)		2881	2676	2594	2717	2696	2717	2764	2758
2000 (Potential)		2910	2799	2696	2764	2764	2676	2943	2764
2030 (Potential)		2820	2553	2512	2594	2594	2615	2758	2615
Arterial and Collector Road Construction/ Reconstruction	Miles								
1986 (Planned)		57	53	77	51	60	52	46	54
2000 (Potential)		45	55	82	55	57	48	38	44
2030 (Potential)		30	45	62	47	47	39	26	32

Table II-3a Average Quantifiable Resource Outputs and Environmental Effects by Alternative (continued)

Outputs/Effects	Unit of Measure	Cur.Dir. (A)	RPA (B)	C	D	Preferred (E)	F	G	H
Timber Purchaser Road Construction/ Reconstruction	Miles								
1986 (Planned)		51	46	70	45	53	46	40	49
2000 (Potential)		40	47	73	47	49	41	32	38
2030 (Potential)		23	34	53	38	37	31	21	25
Roads Subject to Highway Safety Act	Miles								
1986 (Planned)		1450	1450	1450	1450	1450	1450	1450	1450
2000 (Potential)		1470	1500	1550	1501	1501	1499	1490	1492
2030 (Potential)		1533	1610	1786	1655	1680	1621	1535	1573
High Clearance Vehicle Only	Miles								
1986 (Planned)		6250	6250	6250	6250	6250	6250	6250	6250
2000 (Potential)		6232	6251	6350	6256	6255	6246	6210	6219
2030 (Potential)		6292	6295	6594	6271	6370	6287	6191	6243
Fuel Treatment	Thousands of Acres								
1986 (Planned)		16.5	29.6	34.9	27.9	28.5	26.4	20.2	25.5
2000 (Potential)		22.5	24.1	27.4	23.1	23.1	23.8	19.4	23.8
2030 (Potential)		18.0	27.6	28.9	26.6	25.9	24.4	20.7	29.0
Operational Costs	Million $	8.8	9.2	10.0	9.1	9.4	9.0	8.6	9.2
1986 (Planned		8.9	9.2	10.0	9.3	9.5	9.0	8.6	9.3
2000 (Potential)		9.2	10.2	11.0	10.4	10.4	9.9	9.0	10.1
Capital Investment Costs	Million $								
1986 (Planned)		9.0	11.2	13.5	11.0	11.2	10.1	7.5	11.2
2000 (Potential)		10.9	10.2	11.9	9.7	10.1	9.9	7.2	12.2
2030 (Potential)		9.9	11.8	11.8	11.2	11.4	10.1	8.4	11.2
Planned Budget	Million $								
1986 (Planned)		17.8	20.4	23.5	20.1	20.6	19.1	16.1	20.4
2000 (Potential)		19.8	19.4	21.9	18.9	19.6	18.9	15.8	21.5
2030 (Potential)		19.0	22.0	22.8	21.6	21.8	20.1	17.4	21.4
Returns to Government	Million $								
1986 (Planned)		28.8	21.6	34.9	20.6	26.0	24.2	23.8	26.3
2000 (Potential)		17.4	30.1	40.8	30.6	30.7	23.3	23.5	23.2
2030 (Potential)		58.8	54.2	49.5	51.7	52.5	53.1	43.5	44.7
Changes in Jobs	Change in Number								
1986 (Planned)		na	-258	550	-295	-21	-202	-321	-84
2000 (Potential)		738	1808	2584	1981	1865	1611	1249	1406
2030 (Potential)		2834	4778	7382	5934	5398	4936	3021	3646
Changes in Income	Change in Total MM$								
1986 (Planned)		na	-6.4	14.0	-7.3	- .4	-5.0	-8.0	-2.0
2000 (Potential)		7.2	26.3	43.4	28.9	27.6	21.4	15.0	17.4
2030 (Potential)		46.6	70.9	106.8	86.4	79.3	72.4	43.7	52.5
Payments to Counties	Million $								
1986 (Planned)		7.2	5.4	8.7	5.2	6.5	6.0	6.0	6.6
2000 (Potential)		4.3	7.5	10.2	7.7	7.7	5.8	5.9	5.8
2030 (Potential)		14.7	13.5	12.4	12.9	13.1	13.3	10.9	11.2
Lands Tentatively Suitable for Timber Production	M Acres	1,148.7	1,148.7	1,148.7	1,148.7	1,148.7	1,148.7	1,148.7	1,148.7

Table II-3a Average Quantifiable Resource Outputs and Environmental Effects by Alternative (continued)

Outputs/Effects	Unit of Measure	Cur.Dir. (A)	RPA (B)	C	D	Preferred (E)	F	G	H
Acres Available for Specific Resource Uses									
Timber Harvest	M Acres	1,018.9	1,055	1,049.6	1,047.2	1,017.0	1010.2	823.9	949.5
Grazing	M Acres								
Lands Suitable & Appropriate for Regulated/Programmed Timber Harvesting	M Acres	990.8	1,000	1,043.6	994.0	1009.3	950.9	804.1	948.9
Lands Suitable & Appropriate for Regulated/Programmed Timber Harvesting by Yield Category	M Acres					1			
Full Yield		898.6	919.8	1009.4	921.3	952.1	886.6	774.2	886.1
50-99% of Full Yield		92.2	80.6	34.2	72.7	57.2	64.3	29.9	62.8
1-49% of Full Yield		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tentatively Scheduled Timber Harvest	M Acres								
1986 (Planned)									
Clearcut		5.2	4.3	7.6	4.2	5.5	4.1	2.9	4.4
Shelterwood		4.1	10.8	11.7	11.0	10.5	7.9	4.7	7.6
Selection		.0	.1	.1	.1	.1	.1	.1	.1
Overstory Removal		4.0	5.5	5.4	4.4	5.3	5.6	6.7	5.8
Commercial Thin		3.2	3.9	4.4	3.8	4.1	3.7	2.8	5.2
TOTAL		16.5	24.6	29.2	23.5	25.5	21.4	17.2	23.1
2000 (Potential)									
Regen Harvest/ Overstory Removal		17.3	13.8	17.3	13.8	15.3	14.2	11.9	15.9
Commercial Thin		5.2	4.7	4.4	4.7	4.5	4.5	4.5	5.5
TOTAL		22.5	18.5	21.7	18.5	19.8	18.7	16.4	21.4
2030 (Potential)									
Regen Harvest/ Overstory Removal		9.8	11.6	11.6	10.6	11.1	10.3	8.2	10.7
Commercial Thin		8.2	10.8	11.6	11.4	11.8	9.0	9.5	15.9
TOTAL		18.0	22.4	23.2	22.0	22.9	19.3	17.7	26.6
Wild and Scenic Rivers:									
Wild (W)	Miles	0	0	0	0	0	0	0	0
Scenic (S)	Miles	0	0	0	0	0	0	17	17
Recreation (R)	Miles	0	65	0	180	29	11	204	204

---

[1] Thousands of recreation visitor days. All projection based on growth in demand.

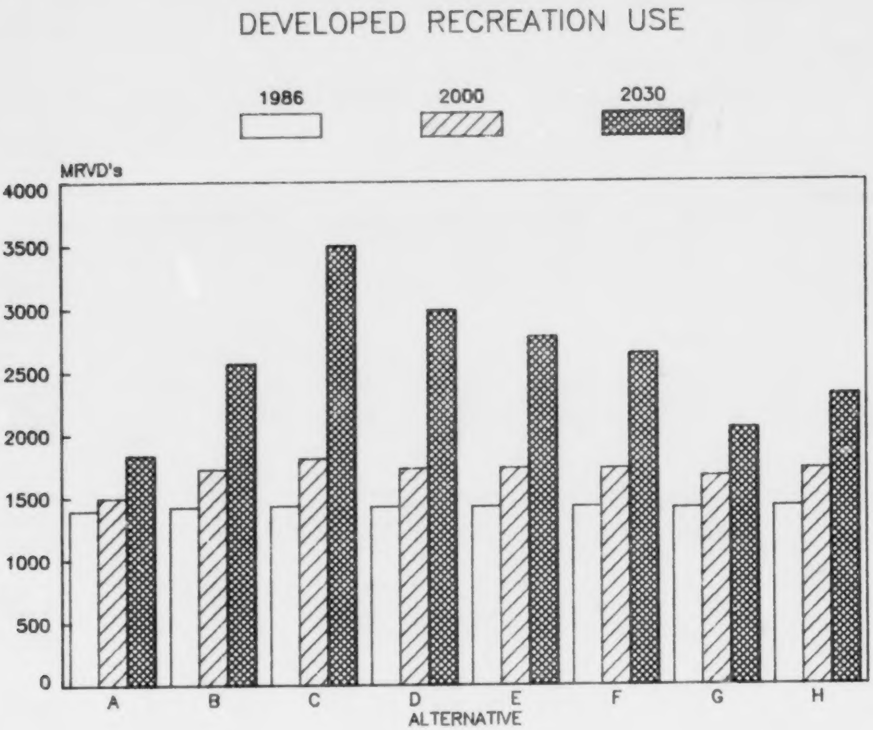
[2] Campground units.

[3] Thousands of wildlife and fish user days.

[4] Thousands of animal units months.

[5] Million board feet.

[6] Million cubic feet.



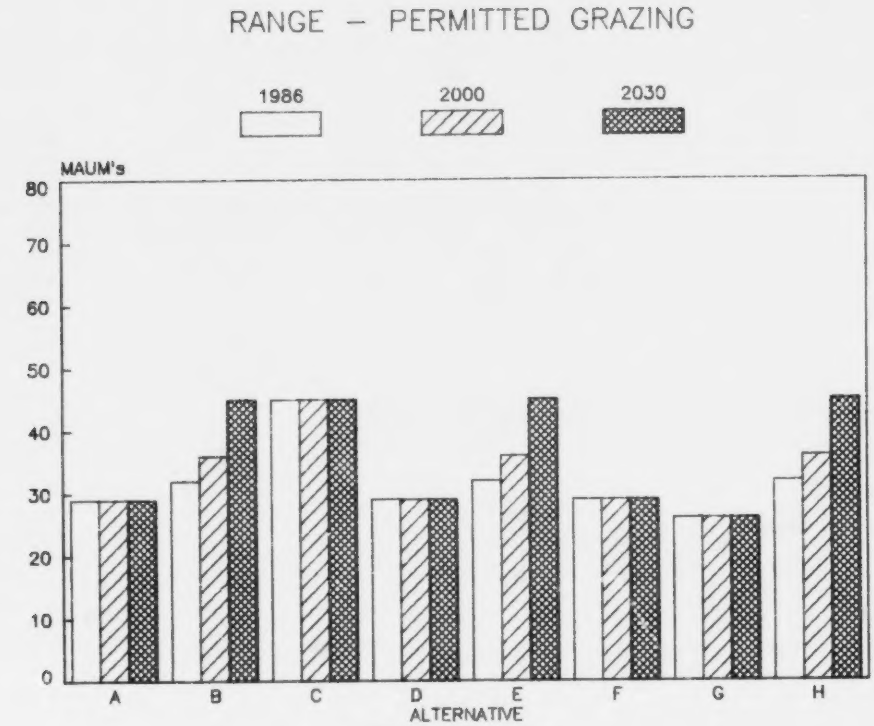
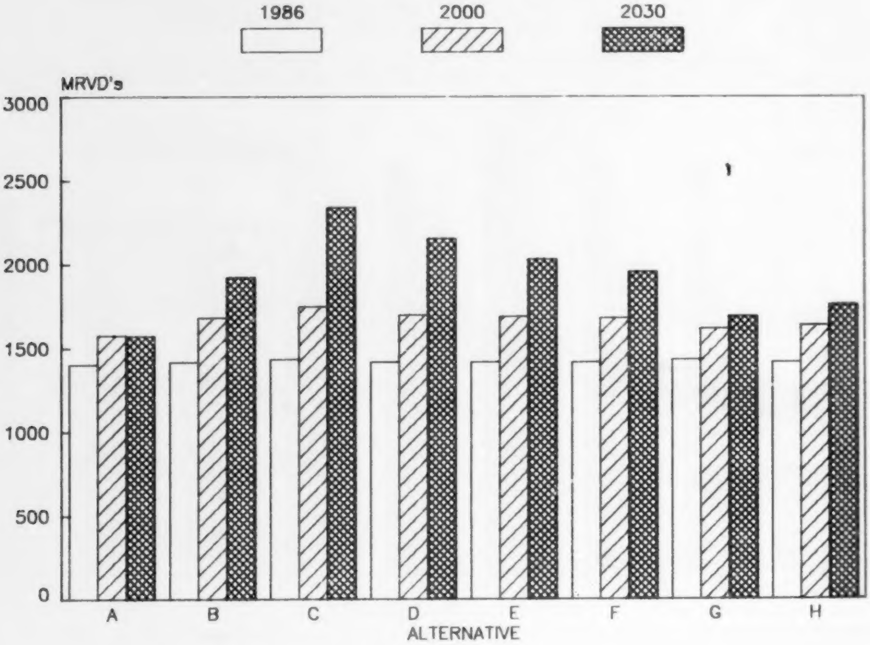


Figure XXIII

NON-WILDERNESS DISPERSED RECREATION
(ROADED)



NON-WILDERNESS DISPERSED RECREATION
(UNROADED)

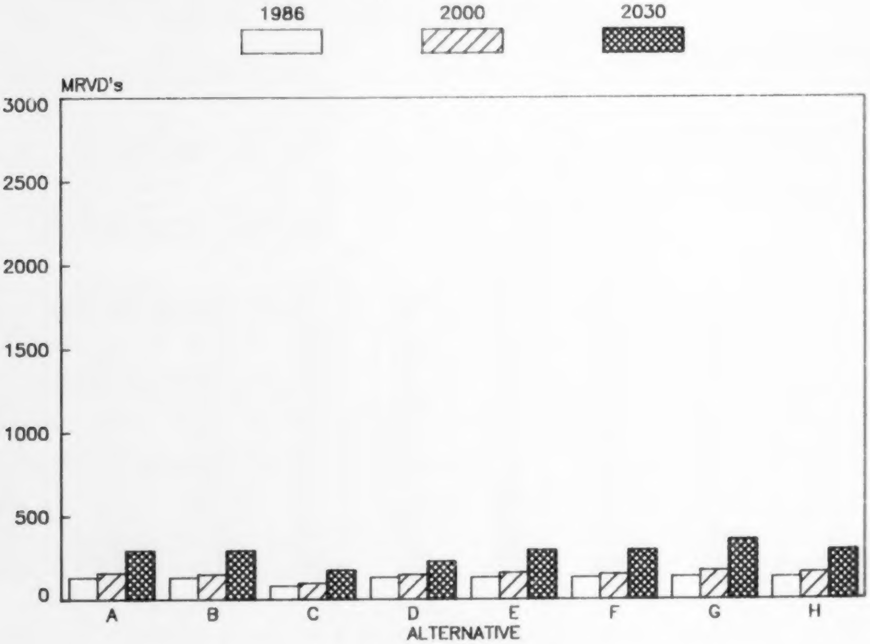
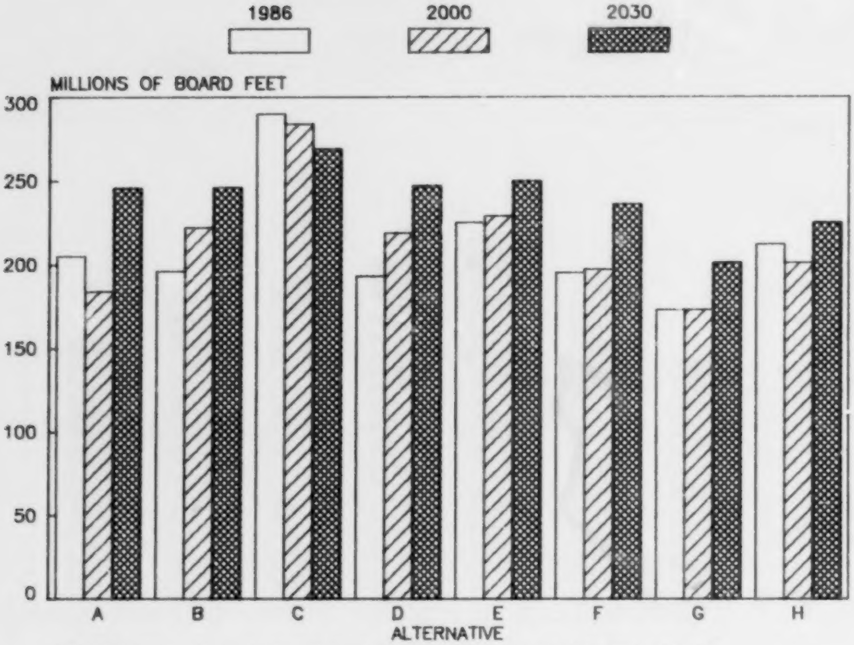


Figure XXIV

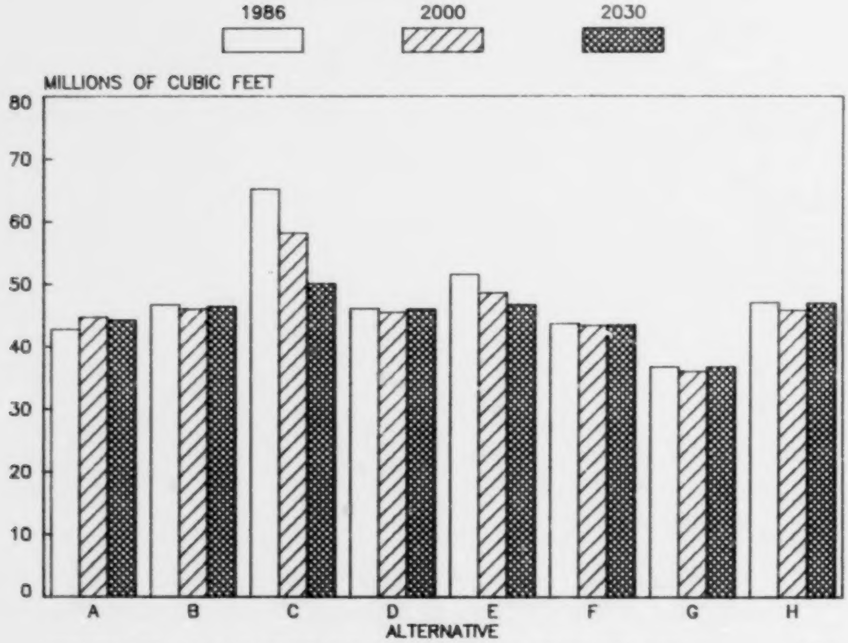
TIMBER OFFERED

BOARD FEET



DEPARTURES: C & E START 2ND DECADE; B & H START 5TH DECADE

CUBIC FEET



DEPARTURES: C & E START 2ND DECADE; B & H START 5TH DECADE 6/85

Figure XXV

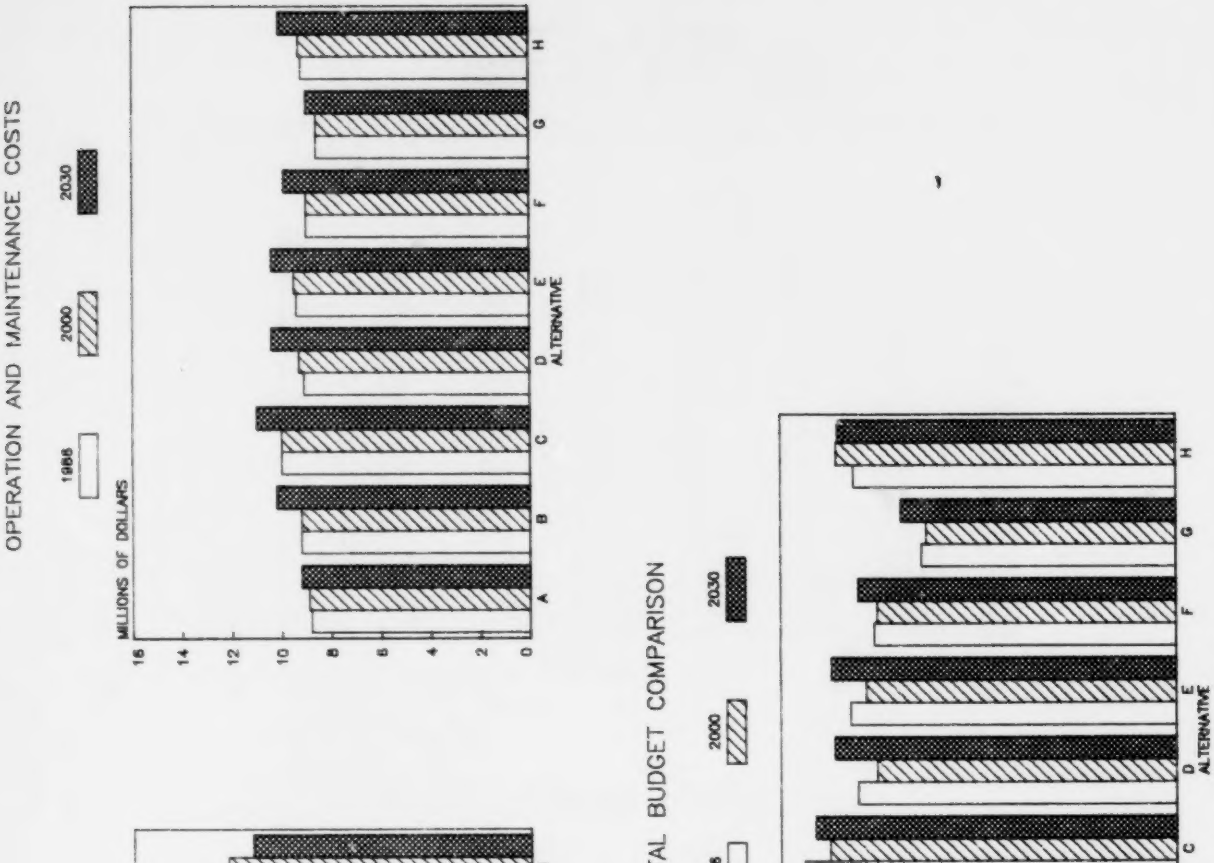
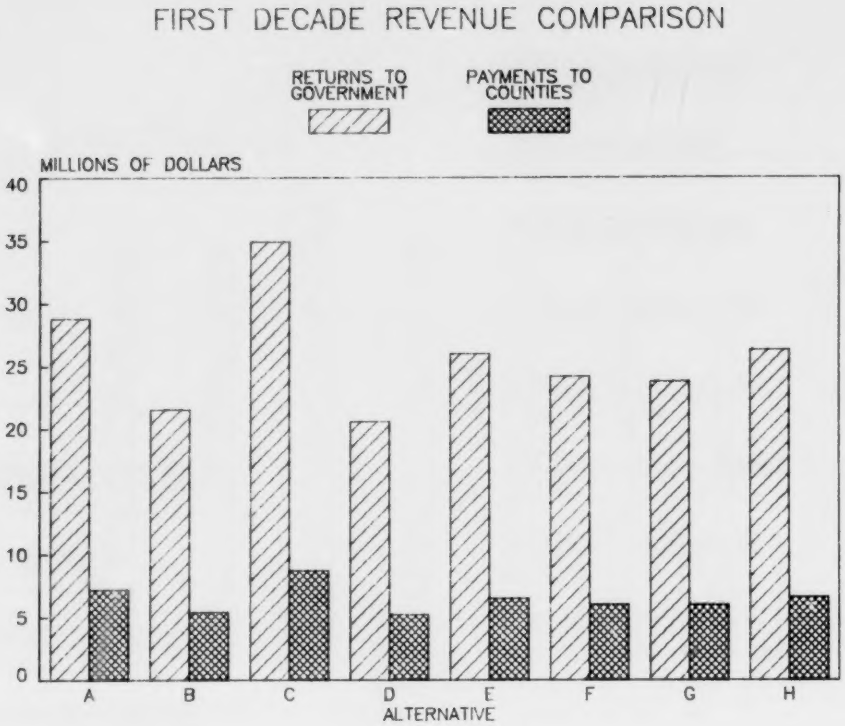

CAPITAL INVESTMENT COSTS
1986
2000
2030
MILLIONS OF DOLLARS
0
2
4
6
8
10
12
14
16
A
B
C
D
E
F
G
H
ALTERNATIVE
OPERATION AND MAINTENANCE COSTS
1986
2000
2030
MILLIONS OF DOLLARS
0
2
4
6
8
10
12
14
16
A
B
C
D
E
F
G
H
ALTERNATIVE
TOTAL BUDGET COMPARISON
1986
2000
2030
MILLIONS OF DOLLARS
0
5
10
15
20
25
A
B
C
D
E
F
G
H
ALTERNATIVE

Figure XXVI



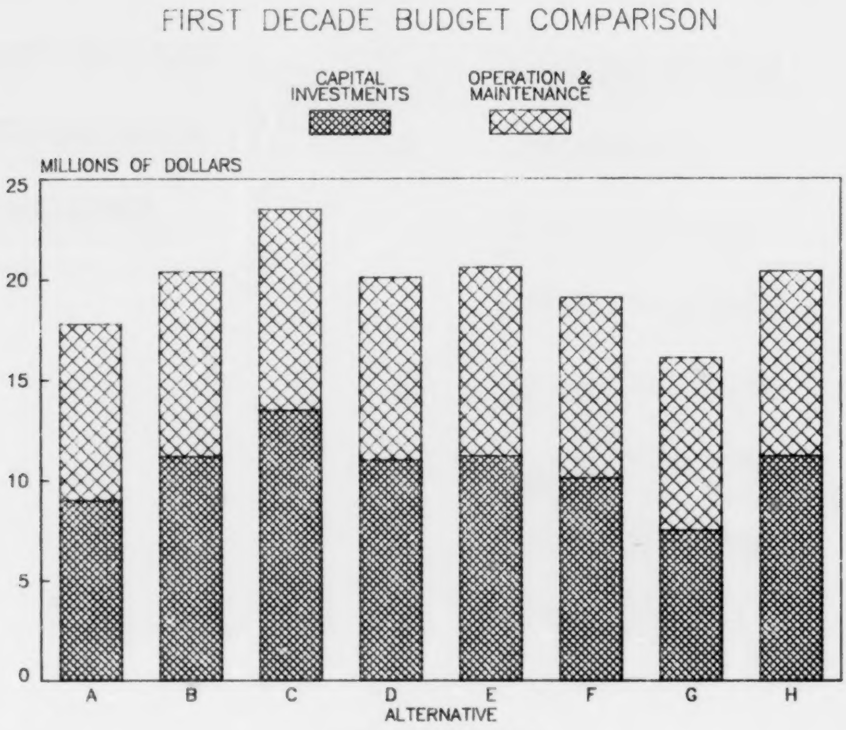
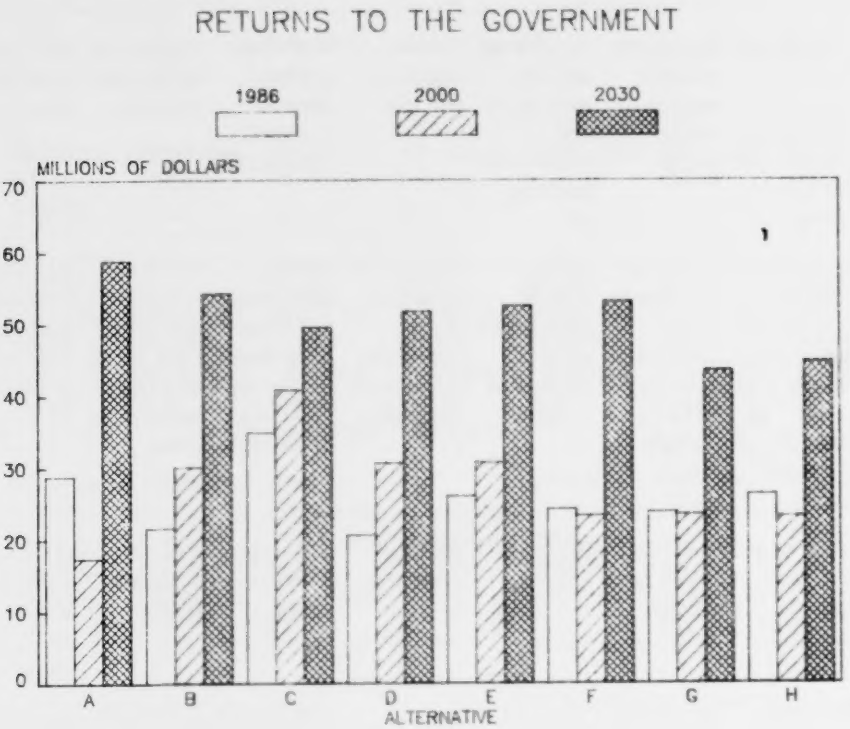


Figure XXVII



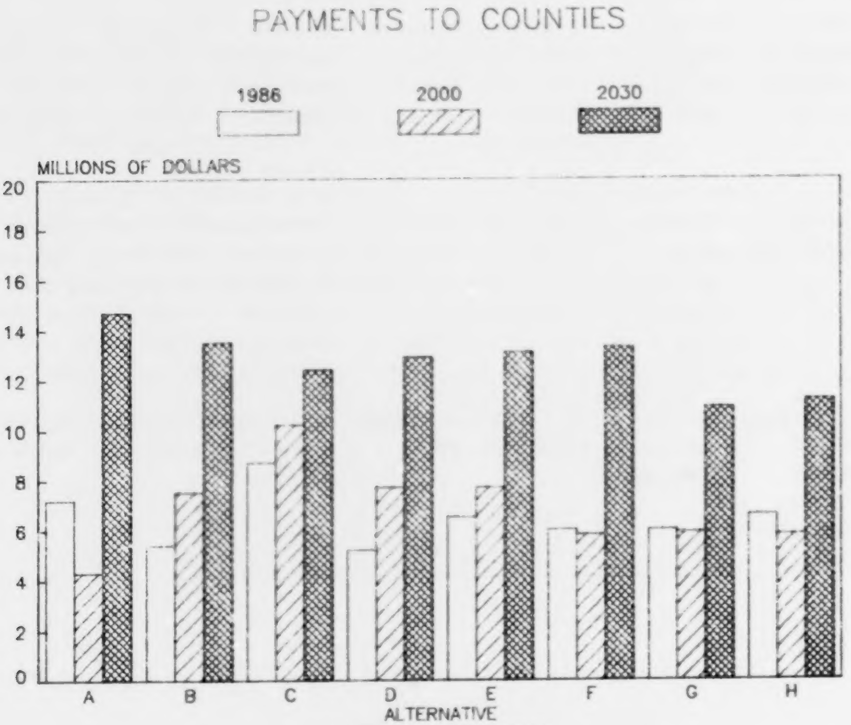


Figure XXVIII

TABLE II-3b Qualitative Resource Outputs and Environmental Effects

Resource Outputs and Environmental Effects	(Cur.Dir.) A	(RPA) B	C	D	(Preferred) E	F	G	H
Air Quality	Temporary and localized reductions in quality due to dust from roads and smoke from burning.	Slight increase in dust and smoke but temporary and localized.	Increase in dust and smoke which could be more continuous and affect more area.	Temporary localized dust and smoke.	Some increase in dust and smoke but temporary and mostly localized.	Temporary and localized dust and smoke.	Some decrease in dust and smoke.	Temporary and localized dust from roads and smoke.
Visual Character of Forest	Subtle changes would occur in areas commonly seen by people. Exception would be areas being treated because of pine beetle epidemic.	Changes would not be apparent in areas commonly seen except where treatment of pine beetle areas is occuring.	The Forest would not appear natural and man's activities would be apparent.	Areas seen by people would change gradually. Rest of Forest would change rapidly.	Most areas seen by people would appear natural except for areas being treated because of pine beetles.	Much of the Forest would appear natural except for areas being treated because of pine beetles.	Much of the Forest would appear natural. Changes would be gradual.	Most of the west side of the Forest would appear natural while the east side would show man's activities.
Changes in Recreational Use Patterns	A wide variety of recreation opportunity available.	A wide variety of recreation opportunity available.	Opportunity oriented at developed and motorized.	Opportunity oriented at day use and motorized.	A wide variety of opportunity available.	A wide variety of opportunity available.	Opportunity oriented at undeveloped and non-motorized.	Opportunity oriented at undeveloped and non-motorized.
Social Effects: a. Community Cohesion	Few problems but conflicts arise.	Could result in polarization.	Would polarize some communities.	Some polarization would occur.	Conflicts should be localized. Cohesion would not be affected.	Conflicts should be localized. Cohesion would not be affected.	Could cause polarization.	Could cause some polarization.
b. Lifestyles	Provides for lifestyles but with increasing restrictions.	Provides for lifestyles but with increased regulation.	Increases jobs but restricts use of the Forest for recreation and firewood gathering.	Increases jobs. Narrows the recreation opportunity.	Maintains jobs and provides for broad recreation opportunity.	Reduces jobs but maintains range of recreation opportunity.	Reduces jobs and limits recreation opportunity.	Reduces jobs some and limits recreation opportunities.
c. Expectations about change.	Does not result in rapid change.	Some change but not dramatically different than current direction.	Change would be viewed as dramatic.	Significant change would occur compared to current direction.	Some change would occur but not dramatically different than current direction.	Change would not be dramatic based on current direction.	Little change would occur.	Little change on west side of Forest with considerable change on east side.
Mountain Pine Beetle a. Losses	Much lodgepole would be destroyed since some areas would not be treated.	Some lodgepole would be lost and not treated.	Little lodgepole would be lost.	Little lodgepole would be lost.	Some lodgepole would be lost.	Some lodgepole would be lost.	Much lodgepole would be lost.	Much lodgepole would be lost.

TABLE II-3b Qualitative Resource Outputs and Environmental Effects

Resource Outputs and Environmental Effects	(Cur.Dir.) A	(RPA) B	C	D	(Preferred) E	F	G	H
b. Future Risk of Epidemic	Epidemic could repeat in future.	Risk is minimized.	Risk would be minimal.	Risk would be minimal.	Risk would be minimal.	Risk would be minimal.	Risk would be high in many areas.	Risk would be high in some areas.
c. Wood and Forage Production	Would not be increased to its full potential.	Some increase would occur.	High production levels would occur.	High production levels would occur.	Some increase would occur.	Some increase would occur.	Slight increase would occur.	Some increase would occur.
Wildlife in General	Habitat provided by mature lodgepole pine would be reduced gradually.	Habitat provided by mature lodgepole pine would be reduced fairly rapidly.	Habitat provided by mature lodgepole pine and other mature stands would be reduced rapidly.	Habitat provided by mature lodgepole pine and other mature stands would be reduced rapidly.	Habitat provided by mature lodgepole pine would be reduced fairly rapidly.	Habitat provided by mature lodgepole pine would be reduced fairly rapidly.	Much habitat provided by mature lodgepole will become dead stands.	Much habitat provided by mature lodgepole will become dead stands.
American Indians	Is compatible with Warm Springs Reservation Comprehensive Plan.	Is compatible with Warm Springs Reservation Comprehensive Plan.	Is not compatible with Warm Springs Reservation Comprehensive Plan.	Is not compatible with Warm Springs Reservation Comprehensive Plan.	Is compatible with Warm Springs Reservation Comprehensive Plan.	Is compatible with Warm Springs Reservation Comprehensive Plan.	Is compatible with Warm Springs Reservation Comprehensive Plan.	Is compatible with Warm Springs Reservation Comprehensive Plan.

While evaluating the outputs and effects of the alternatives and assessing their ability to address the Planning ICOs, it is sometimes useful to know how the output levels of a particular alternative compare with the total potential of the Forest to produce those outputs. Table II-3c presents the output levels of certain key resources for each alternative and selected benchmarks, and compares them to the capabilities of the Forest to produce those outputs. The rows in the table display the benchmarks and alternatives while the columns represent various outputs and effects which vary significantly across the Alternatives. Two numbers are displayed for each row and column intersection in the table. The top number is the production level associated with a particular alternative (row) and output (column). The bottom number is the percent of the potential capability represented by the Alternative's output level.

For example, the maximum PNV benchmark has a present net value of $1501.51 million (row 1 and column 1). Since this benchmark was developed to estimate the maximum present net value of the priced resources (timber, range, and recreation) on the Forest, its present net value represents 100 per cent of the potential capability. The seventh row of the same column displays the present net value of Alternative C at $1285.81 million, or 86 percent of the potential capability.

The remainder of the table may be interpreted in a similar manner. The total potential capability of each of the outputs and effects displayed in the various columns was determined during the Analysis of the Management Situation (AMS). More detail regarding this analysis step is available in the AMS summary of the Forest Plan, the AMS document, Appendix B, and process records.

Table II-3c Comparison of Outputs and Percent of Potential Capability

	Present Net Value Million $	Timber[1] Harvest MMCF	Eagle[2] Population Pairs	M Deer[2] Population	Osprey[2] Population Pairs	Retention & Partial Retention Acres[3]	Dispersed[2] Recreation MRVD's/Yr.	Developed[2] Recreation MRVD's/Yr.	Range[2] MAUM's
Maximum PNV	1501.51	939	45	–	–	–	2622	3666	29
(BM-4)	100%	181%	90%				100%	100%	64%
Maximum PNV	1420.08	506	45	–	–	–	2622	3666	29
(BM-7)	95%	98%	90%				100%	100%	64%
Maximum Timber	–	518	45	–	–	–	1461	1119	29
		100%	90%				56%	31%	64%
Maximum Recreation	–	403	45	30.5	–	277.9	2622	3666	24
		78%	90%	91%		35%	100%	100%	53%
Maximum Wildlife	–	451	50	33.5	180	31.8	1461	1119	16
		87%	100%	100%	100%	4%	56%	31%	36%
Maximum Visual	–	455	45	–	–	484.3	1461	1119	24
		88%	90%			100%	56%	31%	53%
Alternative C	1285.81	598	45	32.3	80	207.4	2686	3493	45
	86%	115%	90%	96%	44%	43%	102%	95%	100%
Alternative F	1125.21	392	45	7.1	80	360.1	2418	2638	29
	75%	76%	90%	81%	44%	74%	92%	72%	64%
Alternative B	1124.13	420	45	8.6	80	365.0	2386	2567	45
(RPA)	75%	81%	90%	85%	44%	75%	91%	70%	100%
Alternative E	1123.41	466	45	5.9	80	344.6	2493	2770	45
(Preferred)	75%	90%	90%	77%	44%	71%	95%	76%	100%
Alternative D	1121.25	413	45	9.8	150	358.6	2551	2983	29
	75%	80%	90%	89%	83%	74%	97%	81%	64%
Alternative H	1027.24	417	45	13.3	180	411.9	2220	2310	45
	68%	81%	90%	40%	100%	85%	85%	63%	100%
Alternative A	741.32	396	20	27.5	180	401.8	2036	1837	29
(Current Direction)	49%	76%	40%	82%	100%	83%	78%	50%	64%
Alternative G	661.27	325	50	16.7	180	426.0	2255	2045	26
	44%	63%	100%	50%	100%	88%	86%	56%	58%

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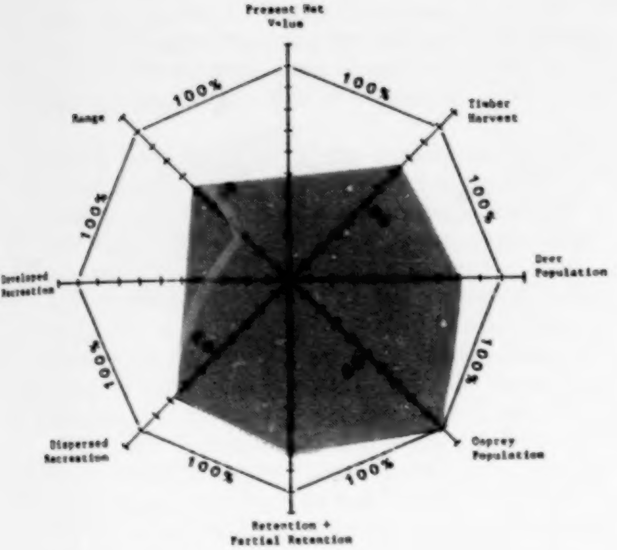
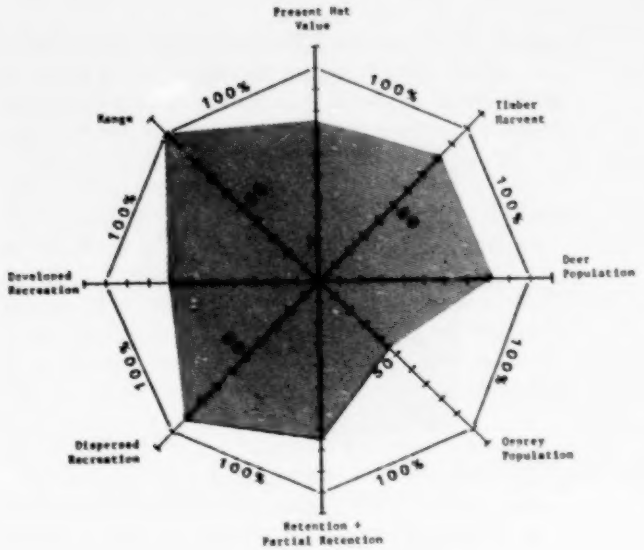
[1] First Decade - Does not include nonchargeable. First decade basically represents the life of a Plan for any alternative.

[2] The fifth decade represents the potential if an alternative were continued for 5 decades.

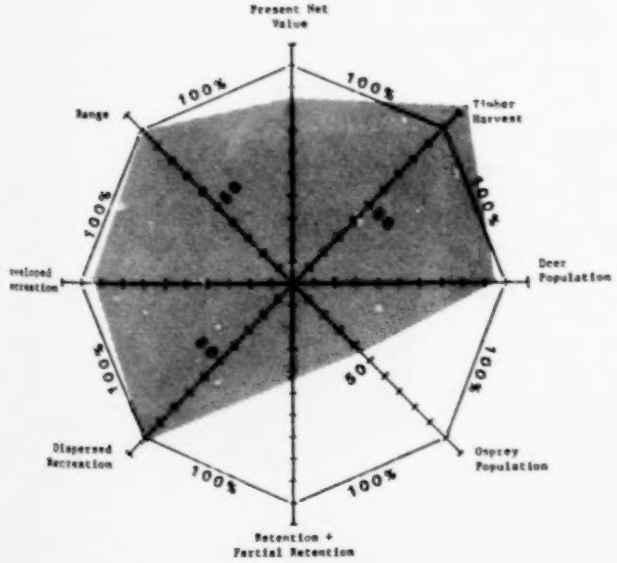
[3] First Decade



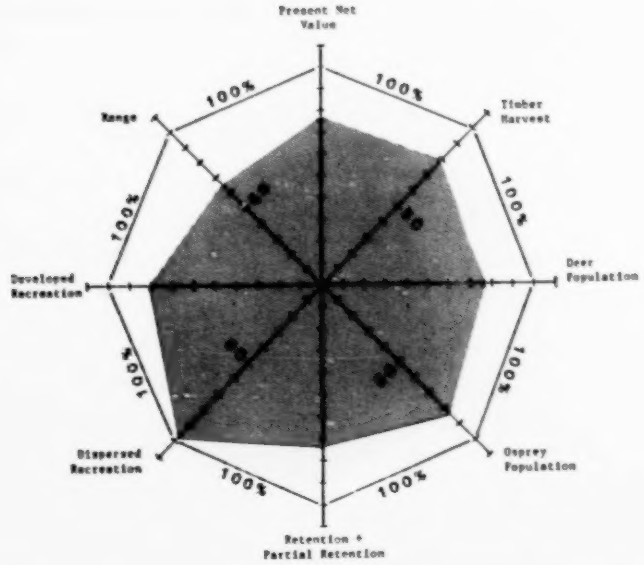
Alternative A



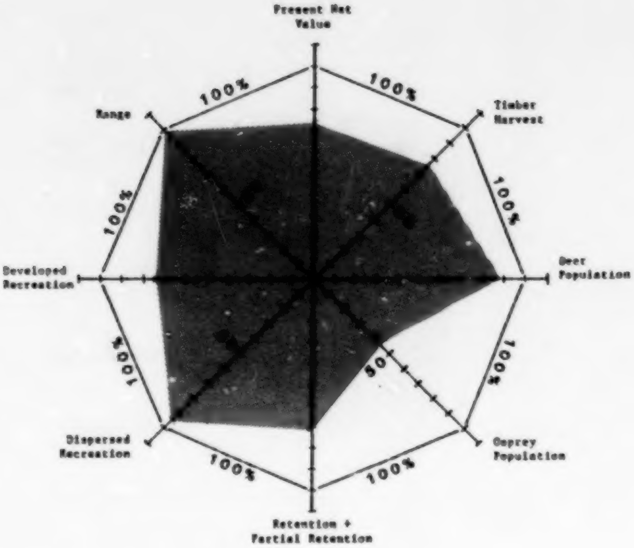
Alternative B



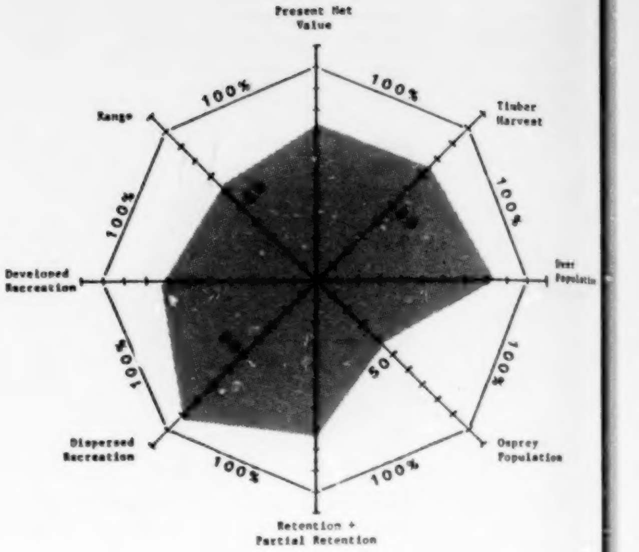
Alternative C



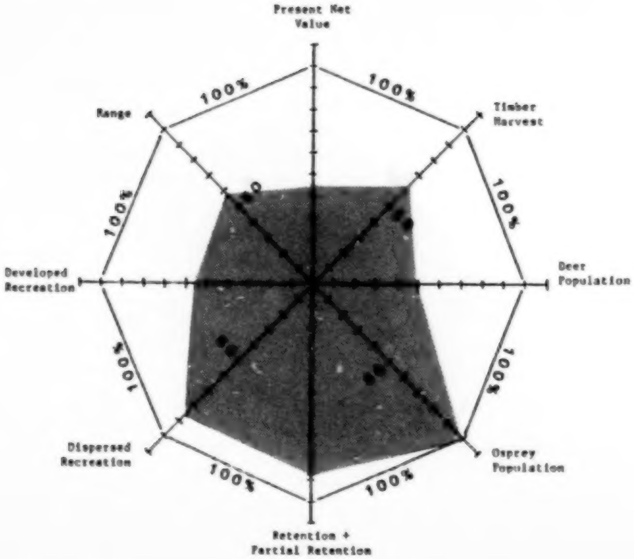
Alternative D



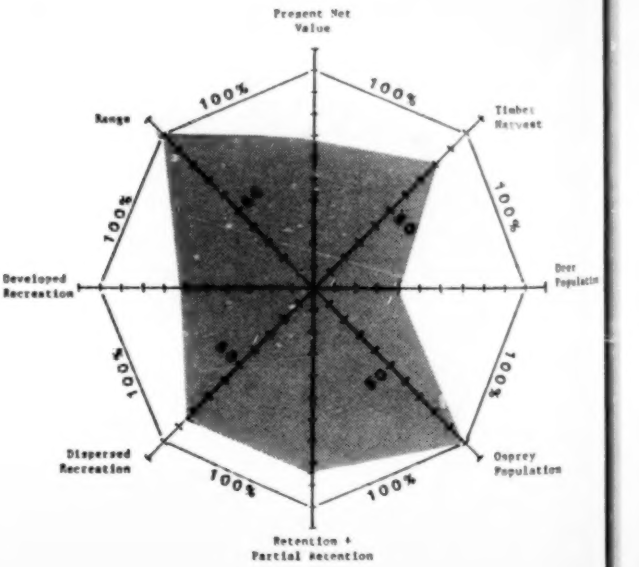
Alternative E



Alternative F



Alternative G



Alternative H

Table II-3d is the final table in this section of Chapter II. It summarizes the development of inventoried roadless areas that would result from the implementation of each of the alternatives. This table does not identify the individual roadless areas. For more information regarding the planned development of individual roadless areas by alternative, refer to Tables IV-4a through IV-4k in Chapter IV.

During the development of the Alternatives, various management strategies were applied to the different roadless areas. A schedule of activities is coupled with these strategies. Some of these strategies such as undeveloped recreation, Research Natural Areas, or old growth, do not permit timber harvesting which is chargeable or road construction. However, other management strategies do involve the scheduling of timber harvesting and its associated road construction activities (i.e., general forest, scenic views, deer winter range, etc.). The consequences of applying these management strategies to the roadless areas which are displayed in Table II-3d and the respective individual roadless area tables in Chapter IV. A Forest Plan for any of the alternatives would be for 10-15 years. As the Forest Plan is revised or redone at the end of 15 years, roadless areas would be evaluated for Wilderness.

Where timber production is part of the strategies applied to a roadless area, the schedule of harvesting was developed with a complex computer model (FORPLAN). The model and its role in the analysis of alternatives is described in detail in Appendix B.

Upon examining Table II-3d, it is apparent that the model did not schedule timber harvesting or road construction during the first decade in any of the Alternatives in any roadless areas.

However, in certain situations there may need to be exceptions to the planned development of these roadless areas as displayed in the table. Many of the roadless areas contain mature and overmature stands of lodgepole pine which is dead and dying as a result of the mountain pine beetle epidemic. Consequently, it may be appropriate to enter portions of the areas for the following reasons: 1) to provide firewood in areas where supplies are becoming limited, 2) to reduce fire hazards to protect adjacent areas or reduce the chance of catastrophic fires, and 3) to salvage material which has a commercial value. Since it is difficult to model this catastrophic situation, the schedule of timber harvesting and road construction activities displayed for these roadless areas may need to be adjusted to reflect the rapidly changing conditions that exist in the mature lodgepole pine stands. In Alternatives G and H, no unscheduled entry into roadless areas would be permitted and the epidemic would be allowed to run its natural course. In Alternatives A through F, unscheduled entries may need to be made in order to treat the lodgepole situation. This is most likely to occur in the North and South Paulina and Bearwallows roadless areas since they are already heavily infested with the mountain pine beetle and are predominantly lodgepole pine.

Table II-3d Summary of Roadless Area Development by Alternative

	(Cur.Dir.) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Preferred) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	145,142	145,142	145,142	145,142	145,142	145,142	145,142	145,142
Acres Available for Development	79,872	85,474	139,718	124,156	100,088	83,349	21,705	40,683
Acres Unavailable for Development[1]	65,270	59,668	5,424	20,986	45,054	61,793	123,437	104,459
Acres Available for Winter Recreation/Geothermal[2]	0	14,202	23,269	8,992	18,262	5,589	0	4,469
Acres of Timber Harvest:[3]								
Decade 1[4]	—— Depends on Mountain Pine Beetle Epidemic ——						0	0
Decade 2	217	2,592	20,109	5,711	5,632	4,711	0	1,141
Decade 3	7,988	0	143	0	9,898	82	0	4,192
Decade 4	1,184	639	17,799	1,353	4,702	1,778	640	2,007
Decade 5[5]	3,131	10,363	29,958	15,868	14,719	9,453	1,981	4,507
Cumulative Miles of Road Construction by:[6]								
Decade 1	—— Depends on Mountain Pine Beetle Epidemic ——						0.0	0.0
Decade 2	2.2	25.9	200.1	57.1	56.3	47.1	0.0	11.4
Decade 5	125.2	135.9	680.1	229.3	349.5	160.2	26.2	118.5
Acres Remaining Undeveloped After:[7]								
Decade 1	145,142	145,142	145,142	145,142	145,142	145,142	145,142	145,142
Decade 2	144,925	142,550	125,033	139,431	139,510	140,431	145,142	144,001
Decade 5	132,622	131,548	77,133	122,210	110,191	129,118	142,142	133,295

[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] First decade basically represnts the life of a Plan for any alternative.

[5] The fifth decade represents the potential if an alternative were continued for 5 decades.

[6] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[7] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

Economic Efficiency Analysis of Alternatives

Introduction

Economic efficiency analysis is required by the National Forest Management Act Regulations (36 CFR 219) and played an important role in the development and evaluation of Forest Planning Benchmarks and Alternatives. Specifically, the Regulations (36 CFR 219.12(f)) state that:

> "The primary goal in formulating alternatives, besides complying with NEPA procedures, is to provide an adequate basis for identifying the alternative that comes nearest to maximizing net public benefits."

In this and following sections, we will explain some of the key concepts and terms related to economic efficiency in general. We will also discuss some of the significant differences between the alternatives and benchmarks with regard to their economic consequences and their responsiveness to the Issues, Concerns, and Opportunities (ICO's). Please refer to Appendix B, Section IV for a more detailed discussion of the process used to analyze economic efficiency for each of the benchmarks and alternatives considered during the development of this DEIS.

Overview of Net Public Benefits, Present Net Value, Priced and Nonpriced Benefits

Net Public Benefits

The maximization of net public benefits is a goal of the Forest Planning process. Net public benefits is the overall value to the Nation of all outputs and positive effects (benefits) less all the associated Forest Service inputs and negative effects (costs), whether they can be quantitatively valued or not. Conceptually, "net public benefits" is the sum of the present net value of priced outputs plus the net value of all non-priced outputs. Net public benefits are maximized by the alternative which has the greatest excess of benefits over costs. A major objective of the Forest Planning process is to provide information that helps determine which alternative provides the mix of outputs and effects that best responds to the ICO's while maximizing the net public benefit of managing the National Forest. Net public benefits cannot be expressed as a numeric quantity because they include the qualitatively valued nonpriced outputs. Therefore, identifying the alternative which maximizes net public benefits is a subjective decision.

Present Net Value

Present net value (PNV), on the other hand, is a dollar measure of economic efficiency. It was the quantitative criterion used to help ensure that each alternative consisted of the most economically efficient combination of priced outputs and management activities needed to meet the objectives of the alternative. "Present net value" is the difference between the discounted value of all priced outputs (benefits) less all Forest Service fixed and variable costs associated with managing the planning area, regardless of whether they were incurred for the production of either priced or non-priced outputs, or as overhead expenses for general maintenance of the organization. Therefore, PNV is an estimate of the current market value of the priced forest resources after all costs of producing both priced and non-priced outputs and meeting other multiple-use objectives have been considered.

The calculation of PNV involves discounting. Discounting is a process for adjusting the dollar values of costs and benefits which occur at different periods in the future to a common time period so that they may be compared. Usually the common time period is the present; in which case, the discounted cash flow is referred to as the present value. The primary discount rate used for the PNV calculations was 4 percent. An alternate rate of 7⅛ percent was also used to evaluate the sensitivity of the results to higher discount rates.

Priced Outputs

Priced outputs are those that are, or can be, exchanged in the market place. The dollar values for these outputs fall into one of two categories: market or nonmarket (assigned). The market values constitute the unit price of an output normally exchanged in a market, and are expressed in terms of what people are willing to pay as evidenced by actual sales transactions. Nonmarket values constitute the unit price of an output not normally exchanged in a market and must be estimated by using some comparable sales transaction data in combination with various theoretical techniques. They are valued in terms of what reasonable people would be willing to pay (above participation costs) rather than go without the output.

Timber and recreation were the most important priced outputs considered during the development of the Alternatives. Together they account for 98 percent or more of the total discounted benefits associated with the benchmarks and alternatives addressed. The remaining benefits were accounted for by the range and mineral resources, and other special uses of the Forest for which permits are required.

Timber was the major resource for which unit prices were based upon observed market transaction data. These dollar values were expressed in terms of dollars per thousand cubic feet (MCF) paid by purchasers at the time of final harvest. The stumpage prices were developed for key individual species sold on the Forest, and were specific to a range of size classes.

Forest-based recreation, on the other hand, is not normally bought and sold in the market place. The values for recreation were based upon the 1985 RPA Program, and were ultimately determined by examining comparable market transaction data in conjunction with some theoretical estimation techniques. The values were expressed in terms of dollars per recreation visitor day (RVD), and were specific to different types and qualities of recreation activities that may be experienced on the Deschutes National Forest.

The range outputs represent the amounts of forage permitted to be grazed and is measured in terms of animal unit months (AUM's). While the Forest receives grazing permit fees, the value received for the AUM's is not based on market prices. Therefore, the dollar values per AUM used in the analysis of the benchmarks and alternatives were based on market price estimations using the Range Budget Approach.

Finally, the Deschutes National Forest collects permit fees for special uses of the Forest. The sources of these fees includes Mount Bachelor Ski Area, recreation residents, other resorts, campgrounds, minerals, lands, and power. The dollar value of these receipts is very small compared to the total Forest priced benefits and does not vary much between the alternatives. The estimated amount received for these permits was based on recent historical transactions on the Forest. These special use permit fees plus timber stumpage receipts constitute the total dollar revenues which the Deschutes receives annually and returns to the U.S. Treasury and local Governments.

Nonpriced Outputs

"Non-priced outputs" are those for which there is no available market transaction evidence and no reasonable basis for estimating a dollar value commensurate with the market values associated with the priced outputs. In these cases, subjective non-dollar values must be attributed to their production.

The calculation of PNV enables the comparison of alternatives with regard to their output levels for priced resources, and their efficiency in producing them. However, the production of nonpriced outputs also influences the decisionmaking process. The importance of the need to consider these subjectively valued benefits in Forest management decisionmaking is addressed in the NFMA Regulations which charge the Forest Service with identifying the alternative which comes nearest to maximizing net public benefits (36 CFR 219.12(F)). Net public benefits (NPB) include both priced and nonpriced resource outputs, less all costs associated with managing the area. As stated earlier, all priced outputs and all costs associated with managing the Forest are included in the calculation of PNV. To this, the net subjective values of the non-priced outputs must be added in order to arrive at the overall NPB of an alternative.

In some cases, the importance of providing non-priced benefits can outweigh the advantages of producing higher levels of priced outputs. Providing for many of the non-priced benefits is achieved by applying constraints to the production of priced outputs (i.e., such as timber harvesting constraints in FORPLAN). These constraints usually result in a decrease in the PNV of the priced outputs to which the constraints were applied. Subjective judgments are then necessary in assessing whether the benefits of producing the non-priced outputs exceed the opportunity costs associated with producing fewer priced outputs. If a PNV tradeoff induced by the provision of a non-priced output is judged acceptable, then a positive contribution to NPB has resulted, and the alternative is more efficient overall.

The non-priced outputs considered during the development and evaluation of alternatives are discussed below. These are all outputs and effects which are influenced to a large degree by decisions regarding how to manage the Forest. They are all the topic of one or more issues and concerns which were identified at the outset of the planning process. While the quantitative dollar values of each can not be determined, they can generally be evaluated by examining such quantitative indicators as acres of appropriate allocations, resource inventories, or timber production related activities and outputs. Some of the most important nonpriced outputs and effects addressed during the Deschutes National Forest planning process revolve around maintaining or enhancing the following:

Lifestyles - Surveys of a Central Oregon populous have shown that many people are attracted to the area for the outdoor lifestyles it can offer them. While this is not to say that jobs and income are not important, many have indicated that their choice to live here was made at the expense of economic interests. A Forest with a broad recreation base in a pleasing environment would be an asset to the Central Oregon area while still providing goods and services necessary for stable Forest based economies.

Central to maintaining and enhancing the Central Oregon lifestyle is the provision of diverse recreation opportunities. The number of recreation visitor days and their associated priced values are included in the PNV calculations for each alternative. However, the assigned dollar values per RVD do not reflect the value of providing a diversity of recreation opportunities and settings. The Forest currently provides adequate recreation diversity as indicated by the reasons many people choose to live and recreate in the area. However, some aspects of the recreation opportunity spectrum are becoming more difficult to retain. For example, as remaining roadless areas are either designated as wilderness, or roaded and developed for other uses, there are fewer opportunities for the semi-primitive and primitive recreation experiences outside of Wildernesses. Related to this is the idea that as more and more roadless areas are either developed or designated as wilderness, future generations will have fewer options regarding how to best manage them to meet changing needs. To the extent that retaining roadless areas in undeveloped conditions does not overly restrict the efficient production of priced outputs, both the recreation diversity and the future options which they offer are considered a non-priced benefit.

The freedom and ability to cut personal use firewood is also important. Different approaches for making firewood available to the public were explored in each of the alternatives. These involved different pricing and allocation strategies, and different rates of using the desirable dead lodgepole pine materials. To the extent that an alternative results in more restrictive access to personal use firewood, the alternative will be less desirable from a lifestyle point of view.

The stability of jobs and income in the area is also an element of the concern about lifestyles. For this purpose, each alternative was analyzed with regard to its potential impacts on jobs and income in Deschutes County (Refer to Appendix B, Section V). Any indications that the implementation of an alternative would result in fewer jobs and less income could be considered disruptive of the current lifestyles.

Suitable Habitat for Threatened and Endangered Species, and Watchable Wildlife - The threatened, endangered, and sensitive wildlife species managed on the Forest include bald eagles and northern spotted owls. Each alternative provides for at least enough habitat to satisfy the Minimum Management Requirements (MMR's) for each of these species. However, some alternatives provide habitat for these species in excess of the MMR's.

The Deschutes National Forest provides habitat for many species which may be classified as watchable wildlife. Ospreys are one of these, and are often thought of as the Forest pet. To the extent that an alternative provides habitat for bald eagles, spotted owls, and ospreys so that their populations may thrive, a nonpriced benefit is realized.

Ecosystem Diversity - Maintaining plant and animal ecosystem diversity over time is also considered as a nonpriced component of net public benefits. Benefits generally associated with ecosytem diversity are gene pool maintenance, scientific research opportunities, and the reduction of insect and disease risks. Since animal diversity is to a large extent dependent upon vegetative diversity, attention is focused particularly on the number of acres for each working group in each successional stage. The amount of old growth provided is especially important since this component would be the most difficult to replace once it disappears. It serves as the focus for evaluating each alternative's impact on ecosystem diversity. The effects of timber harvesting and the risks of wildfire on vegetative diversity were examined for each alternative. To the extent that an alternative provides for the preservation of old growth stands as a component of forested plant communities, the higher the benefits associated with this nonpriced output.

Visual Quality - While the value of visual quality is not directly included in the PNV calculations, its value is indirectly represented through the consideration of recreation as a priced benefit. It is safe to assume that the provision of positive visual experiences has a direct relationship to the quantity and quality of recreation on the Forest. However, a large number of people who benefit from the visually appealing scenery are not tallied as recreation users of the Forest. For example, there are two principal highways which pass through the Forest. The people who drive on these pass through some quality scenic areas. Yet, they are not counted as RVD's. There are also the people who live in or around the Forest who every day enjoy the scenic qualities associated with the forested mountain environment. Again, these beneficiaries are not tallied as RVD's, and the benefits they receive are not measurable in dollar terms.

The alternatives each vary in their emphases to meet inventoried visual quality objectives. This can be measured in terms of the acres of all sensitive retention and partial retention visual quality objectives which are being met through the implementation of an alternative.

Historical and Cultural Resources - A large number of scientifically and historically valuable cultural resources are identified on the Forest. Over 50 new sites, mainly comprising prehistoric Indian campsites, are found each year as a result of the Forest's cultural resource inventory program. Cultural resources are an issue in the sense that many people are concerned about how many and how adequately these cultural sites are being preserved and protected in the face of ground disturbing projects and vandalism that occurs on the Forest. The more areas that are opened up to development for road construction, timber harvesting, and minerals and energy development, the more difficult it will be to protect these resources.

Water Quality- The water quality and conditions along the shorelines of the lakes and streams on the Forest are good. As discussed above, water quality is one of the components which contributes to the outdoor lifestyles of Central Oregonians. In general, sedimentation of streams and lakes on the Forest is not a serious problem. However, to the extent that an emphasis on wood production forces new road construction and harvesting on sensitive steep areas and riparian zones, water quality may experience some degradation.

Air Quality - Air quality is another important aspect of the Central Oregon area. For the most part, air quality conditions are good except during certain times in the winter when temperature inversions create woodstove pollution problems, and certain times in the spring and summer when prescribed burning activities are going on.

Most of the firewood supply utilized in the area comes from the Forest, and is directly related to the amount of accessible beetle- killed lodgepole pine. In the short run (i.e., 5 to 10 years), firewood burning and its related pollution problems will continue to exist. After that, however, the supply situation changes from one alternative to another, and in some cases people may be forced, or choose, to use some other energy source for heat. In which case, some benefits would be realized from improved air quality, even though the benefits of burning relatively inexpensive firewood as a way of life could be reduced.

Air quality degradation resulting from fuels treatment and prescribed burning activities is directly related to the amount of scheduled timber and vegetative management activities associated with an alternative. The more acres of these activities called for in an alternative, the lower the quality of the air during certain seasons of the year.

Economic Comparisons and Tradeoffs Between Alternatives

This section compares and discusses the economic consequences of the alternatives. The section will begin with a general discussion of PNV and the factors which influence it between the alternatives. The section will then cover the implications of the alternatives with regard to budget, returns to the U.S. Treasury, noncash benefits, and economic impacts on the local communities. Finally, the significant incremental changes in PNV from one alternative to another will be summarized. The focus of this discussion will be on the tradeoffs between priced and nonpriced outputs and their effects on the overall ability of the alternatives to address certain key issues, concerns, and opportunities.

In many cases in the tables, figures, and text, refrence is made to various decades. The first decade basically represents the period that would be covered by a Forest Plan while the later decades represent the potential that might occur if an alternative were to continue beyond the first decade. The period covered by a plan for any alternative is 10-15 years.

PNV, Discounted Costs and Benefits, and Their General Relationships to Both Priced and Nonpriced Outputs

Present net value (PNV) is the primary quantitative measure of economic efficiency for each benchmark and alternative. PNV is the sum of market and nonmarket priced values less all management costs discounted to present values at a 4 percent interest rate. A fifty year period was used to make the calculation.

The PNV's of the two Max-PNV Benchmarks (BM-4 and BM-7) and the eight proposed management alternatives are displayed in Table II-4. The alternatives are ranked in order of decreasing PNV. Table II-4 shows the differences in PNV between adjacent pairs of the successionally ranked alternatives. These figures are estimates of the net economic values of the priced resources that would be foregone if a lower-ranked alternative is selected over the preceding one. These relationships are graphically displayed in Figure XXIX.

Before comparing the PNV's, it is first necessary to discuss some of the components of the PNV calculations in order to get a better understanding of the true differences between the alternatives. Displayed in Table II-4 are the present values of the costs and benefits associated with each of the alternatives. Table II-5a presents a more detailed breakdown of the benefits and costs by major resource categories. The PNV for each alternative is the difference between discounted costs and discounted benefits. Figure XXX displays these relationships for each of the alternatives ranked in order of decreasing PNV from left to right.

The discounted costs is the sum of all Deschutes National Forest expenditures for 50 years, discounted to their present value using a 4 percent interest rate. The maximum discounted costs for management of the Forest is $516.8 million for BM-4 while the minimum is $363.8 million for Alternative G. As shown in Table II-5a, the difference in discounted costs between alternatives is primarily accounted for in the amount of funding necessary for timber management and organizational support in order to implement the alternatives.

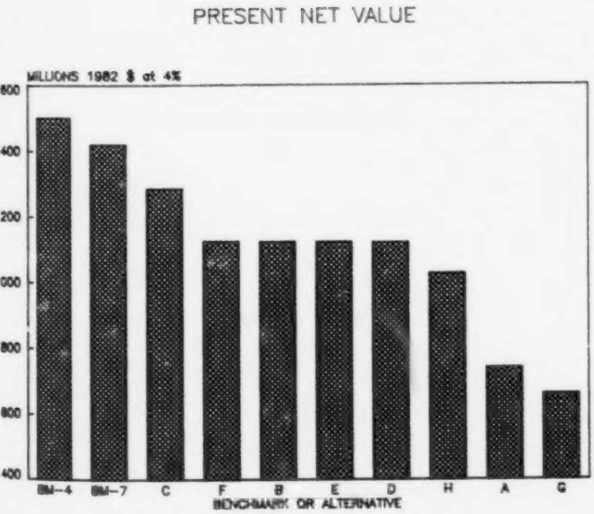


Figure XXIX

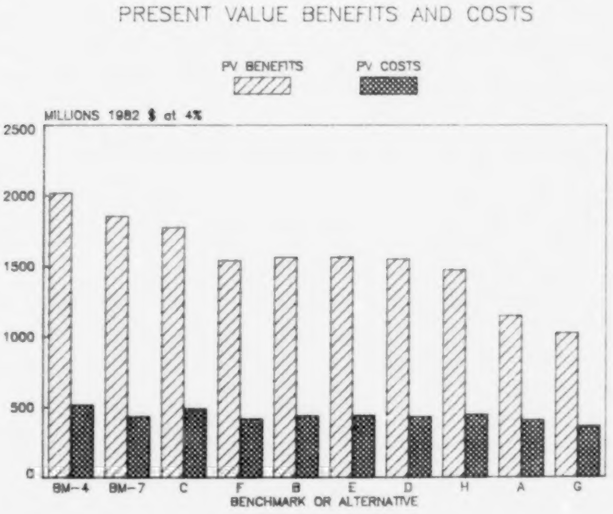


Figure XXX

TABLE II-4 Present Net Value, Discounted Costs, Discounted Benefits, and Benefit/Costs Ratios (Millions 1982 $ @4%)

	Present Net Value		Present Value of Costs		Present Value of Benefits		
	PNV	Difference in PNV	Costs	Difference in Costs	Benefits	Difference in Benefits	Benefit/Cost Ratio
Benchmarks:							
Max. PNV (Run-4)	1501.51	N.A.	516.83	N.A.	2018.33	N.A.	3.91
Max. PNV with CMAI and NDY (Run-7)	1420.08	-81.43	434.17	-82.66	1854.25	-164.08	4.27
Alternatives: (Ranked by Decreasing PNV)							
Alternative C	1285.81	-134.27	489.11	+54.94	1774.92	-79.33	3.63
Alternative F	1125.21	-160.60	416.66	-72.45	1541.87	-233.05	3.70
Alternative B (RPA)	1124.13	-1.08	439.53	+22.87	1563.66	+21.79	3.56
Alternative E (Preferred)	1123.41	-0.72	441.05	+1.52	1564.46	+0.80	3.55
Alternative D	1121.25	-2.16	431.11	-9.94	1552.36	-12.10	3.60
Alternative H	1027.24	-94.01	446.58	+15.47	1473.82	-78.54	3.30
Alternative A (Current Direction)	741.32	-285.92	407.60	-38.98	1148.92	-324.90	2.82
Alternative G	661.27	-80.05	363.83	-43.77	1025.10	-123.82	2.82

TABLE II-5a Discounted Benefits and Costs By Resource Groups (Millions 1982 $ @ 4%)[1]

	Discounted Priced Benefits by Resource							Discounted Costs by Major Categories				
	PNV	Timber	Wilderness Rec.	Disp. Rec.	Dev. Rec.	Range	Spec. Use Permits	Timber	Rec. & Wildlife	Range	Roads	Other (Admin.& Support)
Benchmarks:												
Max. PNV (Run-4)	1501.51	1217.72	43.50	346.16	383.92	6.77	20.25	194.32	46.12	2.52	69.73	204.13
Max. PNV with CMAI and NDY (Run-7)	1420.08	1053.64	43.50	346.16	383.92	6.77	20.25	144.72	45.45	2.52	64.64	176.84
Alternatives: (Ranked by Decreasing PNV)												
Alternative C	1285.81	985.70	39.13	343.76	375.57	10.51	20.25	180.90	47.65	3.90	65.40	191.26
Alternative F	1125.21	786.13	39.13	345.11	345.68	6.77	19.04	144.85	44.40	2.52	53.41	171.47
Alternative B (RPA)	1124.13	809.17	39.13	344.38	343.56	8.43	18.99	157.30	44.33	3.14	57.85	176.91
Alternative E (Preferred)	1123.41	802.63	39.13	347.40	347.78	8.43	19.09	155.23	45.04	3.14	57.17	180.47
Alternative D	1121.25	791.29	39.13	345.54	350.46	6.77	19.17	153.04	44.70	2.52	55.77	175.07
Alternative H	1027.24	739.25	39.13	334.51	333.73	8.43	18.76	169.65	42.44	3.14	52.34	179.01
Alternative A (Cur.Direction)	741.32	781.53	20.75	168.97	153.27	6.77	17.63	148.56	34.55	2.52	50.80	171.16
Alternative G	661.27	635.05	23.07	175.68	167.30	6.07	17.93	111.91	37.12	2.29	56.32	156.20

[1] Direct comparisons of benefits and costs by individual resource provide broad indications of specific relationships, but they may be misleading because many costs are nonseparable under multiple-use management.

The "discounted benefits" for each alternative is the sum of the present values of all market and nonmarket priced benefits for 50 years. As shown in Figure XXX, BM-4 provides the largest amount of discounted priced benefits ($2018.3 million). Of the alternatives, Alternative C produces the most discounted priced benefits at $1774.9 million while Altenative G results in the fewest ($1025.1 million). The differences between the alternatives can be attributed primarily to the timber related benefits and secondarily to recreation. Figure XXXI helps to show this. It presents the discounted benefits for each alternative broken down by market and nonmarket related outputs. The market related benefits are mostly accounted for by timber outputs. The nonmarket benefits are primarily related to recreation. It shows that the market related benefits are the ones that vary the most from the high to the low end of the range in PNV's between alternatives. However, the nonmarket values for Alternative A (Current Direction) and Alternative G are distinctly lower than the nonmarket benefits for the other alternatives. These differences will be explained in more detail below.

It is important to note that none of the economic consequences displayed in this Chapter, whether they be present net values, returns to the government, or impacts on jobs and income in the local economy, include those associated with the possible future development of geothermal resources on the Deschutes National Forest. Substantial geothermal resources are believed to exist on the Forest, but the timing of their development and the extent of their potentials is highly speculative. The potential economic consequences that could result from the development of geothermal are believed to be significant and may vary among the alternatives. For more information regarding the geothermal resources on the Forest and their possible economic consequences, refer to Chapters III and IV.

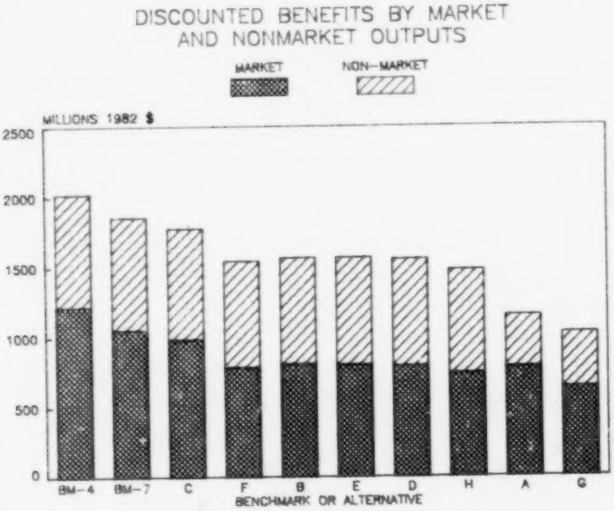


Figure XXXI

"Noncash benefits" is yet another aspect of discounted benefits which needs to be discussed. Noncash benefits refer to the benefits individual resource users receive who are charged less for the resource than they are willing to pay, or current market prices indicate they should pay. They are the difference between the full economic value of the resource and the fees actually paid to use that resource. Noncash benefits are measured by the difference between total discounted benefits less the discounted receipts that are generated by each alternative. The Forest receives revenues for stumpage, grazing permits, campground fees, and other special use permits. Yet, the Forest generates benefits to users which are not realized in terms of cash flows. This is because dollar prices are assigned to nonmarket resources on the Forest in order to reflect their full economic value even though none or only part of that value is collected as fees under current laws and policies.
Timber is the only resource for which the discounted benefits are equivalent to discounted revenues. For all of the other resources, recreation being the primary one, discounted benefits exceed revenues. Figure XXXII displays the relationships between total discounted benefits, receipts, and noncash benefits for each alternative in order of decreasing PNV. The size of the noncash benefit is directly related to the amount of recreation (primarily) and range (secondarily) benefits generated by each alternative.

Comparisons of economic benefits to costs can provide measures of the overall economic efficiency of the alternatives. Both present net value and benefit/cost ratios are measures of economic efficiency. However, and as evident from comparing the present net values and benefit/cost ratios presented in Table II-4, they can produce different rankings of efficiency among the alternatives. Present net value represents the magnitude of difference between discounted benefits and discounted costs, and tends to be higher for alternatives with larger budgets and resource output

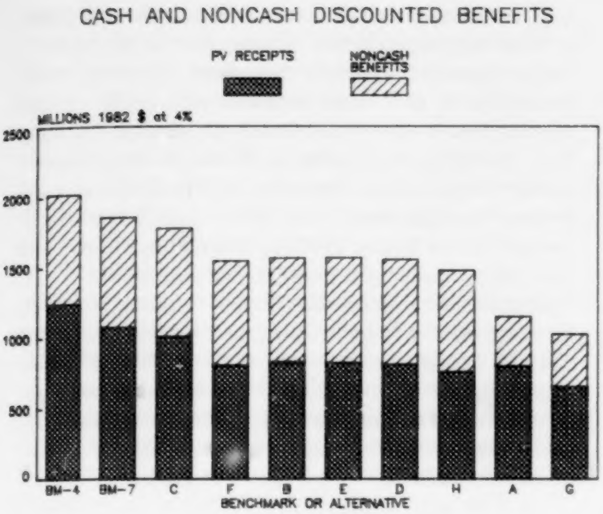


Figure XXXII

levels. On the other hand, benefit/cost ratios are derived by dividing the discounted benefits by discounted costs. Benefit/cost ratios better reflect the efficiency with which dollars of expenditures are used to generate benefits, and have little to do with the magnitude of resource output levels. The benefit/cost ratios for each of the alternatives in order of decreasing PNV from left to right are also displayed in Figure XXXIII.

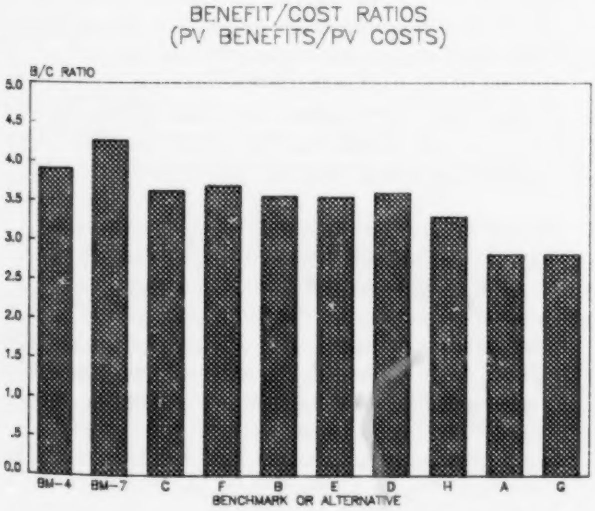


Figure XXXIII

The two Max-PNV Benchmarks (BM-4 and BM-7) are presented as reference points only. While they meet the minimum legal requirements of managing the Forest, they do not represent viable alternatives because they were not designed to respond to the ICO's. They represent the maximum net economic returns available if the priced resources on the Forest were managed solely to maximize present net value. The primary difference between the two benchmarks is the way timber is scheduled for harvesting. BM-4 permits departure from nondeclining yield and stand rotation ages which are based solely on maximization of present net value. It has the highest PNV ($1501.5 million). BM-4 also has the highest first decade average annual harvest level of 89.1 MMCF; 95 percent of which is the higher valued ponderosa and mixed conifer species working groups as opposed to the significantly lower valued lodgepole pine and mountain hemlock working groups.

BM-7 harvests timber on a nondeclining yield basis and stands must have at least reached 95 percent of biological culmination (which generally occurs later than the rotation age at which PNV is maximized) before being considered for final harvest. It has the second highest PNV ($1420.1 million). It provides first decade average annual harvest levels of 49.0 MMCF; all of which are ponderosa pine and mixed conifer working group species. While both of these contain land allocations for the important developed recreation areas on the Forest (approximately 40 percent of their discounted benefits are recreation related), they provide little else in terms of multiple resource management. Note that while BM-7 ranks second in present net value, it has the highest benefit cost ratio.

The PNV's for the alternatives range from $1285.8 million for Alternative C to $661.3 million for Alternative G. Alternative C offers the highest first decade average annual harvest levels of all the alternatives (59.8 MMCF), while Alternative G provides the lowest (32.5 MMCF). While Alternative C has a higher first decade average annual timber program than BM-7 (59.8 MMCF as compared to 49.0 MMCF), 45 percent of its volume is comprised of the lower valued lodgepole pine working group. The recreation related benefits between Alternative C and BM-7 are relatively comparable. Therefore, it's important to note that not only is the amount of timber offered for sale an important component of PNV, the mix of species is also a significant factor. In fact, one of the principal differences in the timber programs between the benchmarks and the alternatives is the species mix. All of the alternatives had one form or another of an accelerated lodgepole harvesting program (mature lodgepole conversion periods from 10 to 30 years) in order to address the mountain pine beetle epidemic issue. The benchmarks did not attempt to respond to this issue at all and, therefore, did not accelerate the harvesting of lodgepole. This permitted them to harvest the more valuable ponderosa pine and mixed conifer species earlier which helps to contribute to their higher PNV's.

Generally, as the discounted costs decrease from one alternative to another, so do the PNV's. This can be interpreted to mean that additional investments in resource management between the alternatives usually result in relatively greater returns in terms of increased benefits.

While these relationships hold as a generality, there are exceptions. For example, Alternatives C, B, E, and H incur higher discounted costs than the alternatives preceding them in the PNV ranking. For various reasons, they did not benefit from the same types of investment returns as did the other alternatives. This is apparently due to the fact that the benefit/cost ratios for the departure alternatives tend to be lower than comparably ranked alternatives (based on PNV) which harvest based on nondeclining yield. In order to understand these complex relationships between PNV, discounted benefits, and discounted costs, a more in-depth examination of their components is needed. Table II-5a presents the discounted benefits and costs by major resource groups for each alternative. Note that it would be incorrect to assume a direct relationship between the dollar benefits associated with a particular priced output and the cost figure assigned to it. This is because the production of any specific priced output is generally supported by a complex combination of multi-functional input costs. However, they do provide some insight into the complex financial relationships that exist between the alternatives.

Most, although not all, of the cause for the exception in the relationship between PNV and discounted costs for Alternatives B, C, E, and H can be explained by examining the timber related costs and benefits. All four of these alternatives are departures from nondeclining yield. Except for Max-PNV (BM-4), all of the other alternatives harvest timber on a nondeclining yield basis. Given their respective land use prescriptions and resource management objectives, all four of these alternatives had to incur relatively higher per unit timber management, road construction, and organizational support costs than the alternatives preceding them in PNV ranking in order to meet their departure timber output objectives. In general, the departures caused them to harvest in areas with higher access cost and/or lower valued timber. In comparing Max-PNV (BM-7) to Alternative C, the latter receives 6 percent fewer timber benefits at 25 percent more timber management costs. Alternative B receives 3 percent more timber benefits than Alternative F, but only after investing 8 percent more in timber management. Finally, Alternative H receives 7 percent fewer timber benefits than Alternative D, but incurs 11 percent more timber management costs. These figures do not include the higher road construction and organizational support costs also associated with these departure alternatives.

Table II-5a also shows that from 40 to 75 percent of the total discounted benefits for any alternative can be attributed to the timber resource. Recreation (Wilderness plus Dispersed plus Developed) accounts for anywhere from 25 to 60 percent of the benefits for any one alternative. Timber is responsible for the majority of the discounted benefits for all of the benchmarks and alternatives—ranging from 50 to 68 percent of the totals. Together, timber and recreation benefits sum to more than 97 percent of the total discounted benefits for each alternative.

Except for Alternative A (Current Direction) and Alternative G, timber related discounted costs and benefits account for the primary differences between the PNVs for the alternatives. Timber related benefits range from $1217.7 million for BM-4, to $985.7 million for Alternative C, to $635.1 million for Alternative G. This is a total difference of $582.6 million, and represents an increase of 92 percent from the lowest to the highest timber related benefits received amongst the alternatives. Timber management costs range from $112 million for Alternative G (the lowest) to $194 million for BM-4 (the highest). This is an increase of 73 percent.

Except for Alternative A (Current Direction) and Alternative G which have respective recreation benefits of $343 million and $366 million, the recreation benefits for the other alternatives have a relatively narrow range (from $773.6 million to $707.4 million). This is despite the wide range in recreation land prescriptions between the alternatives. The Alternatives reflect a relatively narrow range in recreation benefits because it was assumed that in the short run, the propensity to participate in recreation would not change much between the alternatives. What would change is where they recreated on the Forest. What differentiates the

Alternative A and Alternative G recreation benefits from the other alternatives is the quality of recreation experience managed for in these two alternatives. They provide lower standards of recreation experiences and, therefore, lower valued recreation outputs than do the other alternatives. This is because of the existing budget levels for Alternative A (Current Direction) and the resource management objectives for Alternative G.

The differences in PNV between the alternatives can also partly be attributed to the levels of nonpriced outputs which they provide. While these outputs can not be valued in dollar terms, their output levels can often be measured in terms of other units. Table II-5b presents information which is useful in helping to understand the relationships between some of the key nonpriced ouputs and present net value. It is important to keep in mind that this table is intended to present only general relationships between the nonpriced benefits and PNV. The differences in the output levels and effects should not be interpreted as absolute measureable tradeoffs. Figures XXXIV through XXXVIII graphically depict the surrogate measures of output levels for the nonpriced outputs which will be discussed in the next few paragraphs.

It is important to note that the provision of some nonpriced benefits is complementary to the production of priced outputs while the provision of others is contradictory. The contradictory relationships generally mean that more nonpriced outputs can only be provided at the expense of producing fewer priced outputs (primarily timber) and, therefore, lower PNV's. It is a subjective decision as to whether the foregone priced benefits are at least compensated for by the increased outputs of nonpriced benefits.

Maintaining and enhancing the lifestyles of Central Oregonians was identified as one of the more important nonpriced benefits. Of course, this is comprised of several components including the opportunity for diverse recreation experiences in a visually pleasing environment along with clean air and water. Economic stability is also a factor. For this discussion we will cover these as separate nonpriced outputs and in no particular order of importance.

Maintaining and enhancing economic community stability can mean many things to different people and can be measured in various ways. Table II-5b presents the change in the number of jobs in the

TABLE II-5b Present Net Value Change, Returns to Treasury and Counties, and Key Nonpriced Outputs

	PNV @4% ($MM)	Chge.In PNV ($MM)	PV Costs @4%s ($MM)	Chge. In Costs ($MM)	1986 Returns To Treas. ($MM)	1986 Payments To County ($MM)	Chge.In Employ. 1st Dec. (Jobs)	Firewood Reserved For Pers.Use (MCords)	Visual Quality Ret. & Part.Ret. (MAcres)	Eagles, Owls,& Osprey (MAcres)	Unroaded Undev. & Winter Rec. Allocations (MAcres)	Timber Harvests Decades 1 and 2 (MAcres)
Benchmarks:												
Max PNV(Run-4)	1501.5	N.A.	516.8	N.A.	81.0	20.3	+2060	0	0.0	22.6	0.0	604.1
Max PNV(Run-7)	1420.1	-81.4	434.2	-82.7	47.6	11.9	+560	0	0.0	22.6	0.0	386.1
Alternatives:												
Alt. C	1285.8	-134.3	489.1	+54.9	34.9	8.7	+550	0	207.4	22.6	27.5	508.5
Alt. F	1125.2	-160.6	416.7	-72.4	24.2	6.0	-202	60	360.1	36.6	73.0	400.4
Alt. B (RPA)	1124.1	1.1	439.5	+22.9	21.6	5.4	-258	60	365.0	37.4	88.2	429.9
Alt. E (Preferred)	1123.4	-0.7	441.1	+1.5	26.0	6.5	-21	60	344.6	37.4	77.4	462.5
Alt. D	1121.3	-2.1	431.1	-10.0	20.6	5.2	-295	0	358.6	56.4	37.9	418.2
Alt. H	1027.2	-94.1	446.6	+15.5	26.3	6.6	-84	75	411.9	68.5	126.2	445.4
Alt. A (Cur. Dir.)	741.3	-285.9	407.6	-39.0	28.8	7.2	0	60	401.8	13.1	57.4	390.1
Alt. G	661.3	-80.0	363.8	-43.8	23.8	6.0	-321	75	426.0	67.3	133.7	336.1

local economy during the first decade that could result from the implementation of an alternative. To some extent, the payments to county also provide some insight into the economic base from which the local Governments can provide services to residents of the area. In general, both of these have complementary relationships with the production of priced benefits. "Payments to counties" is calculated as 25 percent of total Forest Service receipts, 99 percent of which are related to harvesting timber. In turn, many jobs in the local economy are directly related to the amount of timer and recreations supplied from the Deschutes National Forest. Table II-5b indicates that, as PNV decreases along with the production of priced timber and recreation ouputs, so do the payments to counties and potential number of jobs in the economy.

With regard to the job estimates, one point needs to be explained. Timber related jobs in the area are estimated as a function of the amount of board feet sold from the Forest. While in terms of cubic feet of wood fiber sold, Alternative G is the only alternative which provides lower outputs than Alternative A (Current Direction). However, in terms of board feet, all alternatives except for the two benchmarks, plus Alternative C and Alternative E (Preferred) offer less wood for sale (Refer to Table II-3a for these relationships.) This anomaly occurs because of the relative share of the total timber harvest volumes in these alternatives which is lodgepole pine. Lodgepole is a relatively small tree. Because of this, fewer usable boards can be milled from the cubic feet of fiber which exist in its stem. In addition, many of the local mills now process these small diameter trees in automated (relatively low labor) mills. Therefore, the substitution of lodgepole pine volume for the volumes from larger trees such as ponderosa pine has a downward pressure on the employment base in the area.

The ease of accessibility to personal use firewood from the Forest is also a component of the Central Oregon lifestyle and considered a nonpriced benefit. Different alternatives investigated various ways of pricing and rationing this material to its end users. The two benchmarks, plus Alternative C, and Alternative D put this material up for sale to the highest bidder. None was set aside for personal use. The other alternatives each set aside either 60 or 75 thousand cords per year for personal use firewood cutters. These relationships are depicted in Figure XXXIV. To the extent that personal use firewood permits are priced below what this material would normally sell for on the competitive market, the rationing of personal use firewood supplies has a slight downward pressure on PNV (although the amount of decrease in PNV would probably be small).

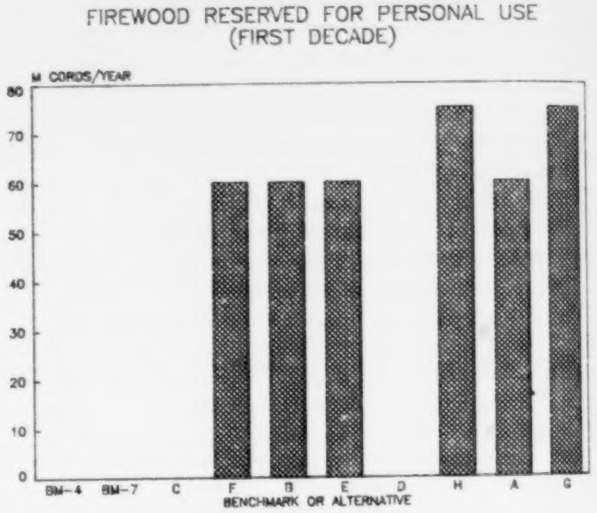


Figure XXXIV

The maintenance or enhancement of visual quality in sensitive scenic areas is another nonpriced benefit. In Table II-5b and Figure XXXV this output is presented in terms of the amount of acres of retention and partial retention visual quality objectives met in each alternative. While some timber harvesting is acceptable, and even necessary, in order to meet the visual management objectives in scenic areas, the provision of visual quality on the Forest usually comes at some expense to the amount of timber that could be harvested. As more acres are allocated to visual management across the alternatives, the lower the PNV tends to be.

The provision and maintenance of habitat for bald eagles, spotted owls, and osprey are also considered a nonpriced benefit. Again, timber harvesting is permitted in these areas, but at reduced levels. Table II-5b and Figure XXXVI depict the amount of habitat provided for these species for each alternative. Generally, as the amount of acres managed for their habitat increases, PNV decreases.

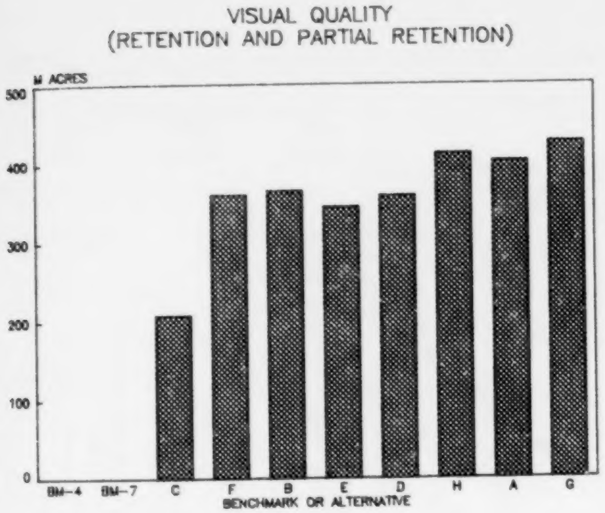


Figure XXXV

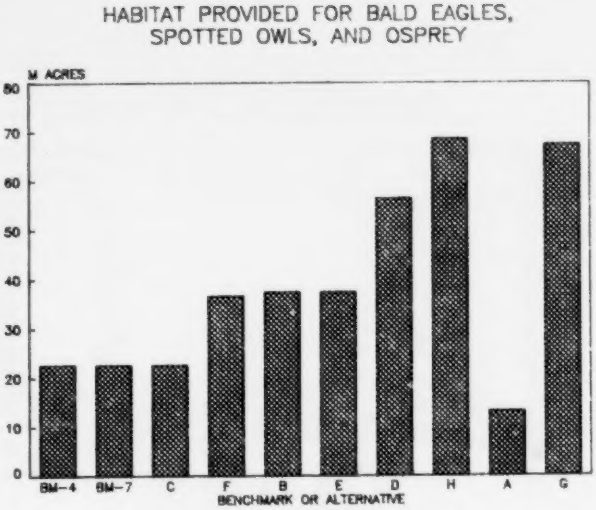


Figure XXXVI

The provision of opportunities to participate in diverse recreation experiences is another nonpriced benefit. Recreation diversity on the Deschutes is most limited by the amount of opportunities to recreate in unroaded nonwilderness areas. In Table II-5b and Figure XXXVII, this output is measured in terms of amount of unroaded, undeveloped and winter recreation allocations outside of Wilderness. The tradeoffs between this output and timber are the most extreme. On most of these areas, no programmed timber harvesting is permitted. The conflicting relationship between the provision of recreation diversity and PNV is apparent; the more recreation diversity in terms of unroaded nonwilderness recreation, the lower the timber program, and the lower the PNV.

The maintenance and enhancement of clean air and water, and the protection of historical and cultural resources, are also, at least to some extent, contradictory to the harvesting of timber. While the provision of these benefits has not been a serious problem in the past, alternatives which greatly increase the amount of acres harvested will make it more difficult to protect these resources. Table II-5b and Figure XXXVIII show that as PNV increases, so do the number of acres harvested.

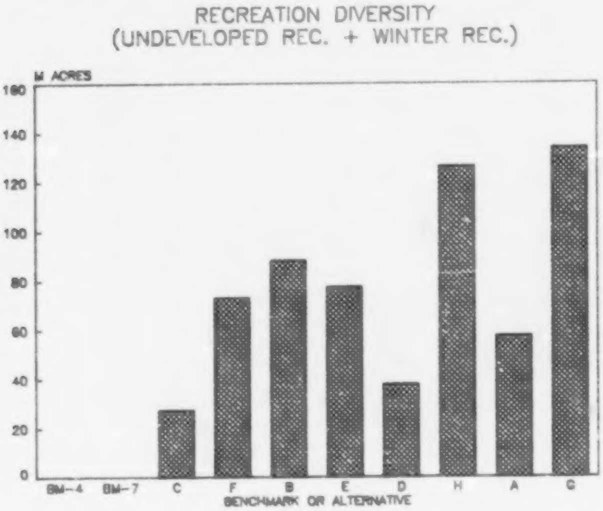


Figure XXXVII

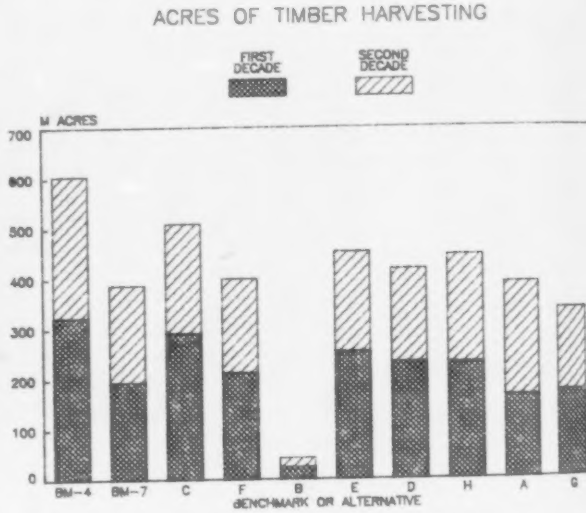


Figure XXXVIII

U.S. Treasury Cash Flows: Budgets and Receipts

Net returns to the U.S. Treasury are defined as the difference between the total dollar receipts of an alternative and the budget required to implement that alternative. Table II-6 displays the net cash flows, total budgets, total receipts, and noncash benefits by alternative for the first and fifth decades. The first decade basically represents the life of a plan which is 10-15 years while the fifth decade represents the potential if an alternative were carried forward for five decades. The alternatives are ordered in terms of decreasing first decade net cash flows. Note that returns exceed budgets for all alternatives in all decades except BM-4 and BM-7 in the fifth decade. In both of these benchmarks, the fifth decade harvests are comprised mostly of lower valued lodgepole pine stands in areas where the costs of doing business is increased by additional roading, logging, and stand management expenditures.

The receipts presented in Table II-6 represent actual dollar revenues generated by each alternative. For all alternatives, timber stumpage revenues account

TABLE II-6 Average Annual Net Receipts to the U.S. Treasury (Millions 1982$)[1]

	Decade 1[2]				Decade 5[3]			
	Net Cash Flow	Total Costs	Total Receipts	Noncash Benefits To Users	Net Cash Flow	Total Costs	Total Receipts	Noncash Benefits To Users
Benchmarks:								
Max. PNV (Run-4)	58.5	25.7	84.2	27.5	-9.1	19.8	10.7	57.1
Max. PNV (Run-7)	31.0	18.5	49.5	27.4	-12.3	25.1	12.8	57.1
Alternatives:								
Alt. C	12.8	23.5	36.3	27.4	26.7	22.8	49.5	54.5
Alt. A (Cur. Direction)	12.2	17.8	30.0	14.5	39.8	19.0	58.8	18.8
Alt. G	8.7	16.1	24.8	14.7	20.8	22.7	43.5	20.6
Alt. H	7.0	20.4	27.4	27.5	23.3	21.4	44.7	40.9
Alt. F	6.8	19.1	25.9	27.5	34.4	20.1	54.5	45.2
Alt. E (Preferred)	6.5	20.6	27.1	27.5	30.7	21.8	52.5	47.2
Alt. B (RPA)	2.1	20.4	22.5	27.6	32.2	22.0	54.2	44.5
Alt. D	1.4	20.1	21.5	27.6	30.1	21.6	51.7	49.0

[1] Costs are limited to Forest Service or taxpayer expenditures. Twenty-five percent of the receipts would be paid to counties.

[2] First decade basically represents the life of a Plan for any alternative.

[3] The fifth decade represents the potential if an alternative were continued for 5 decades.

for over 95 percent of the total receipts. The remainder of the receipts are attributed to from campgrounds and other special use fees collected from Mt. Bachelor Ski Area, recreation residents, other resorts, range permitees, minerals, lands, and power. Figure XXXIX depicts the estimated average annual receipts by alternative for the first, second, and fifth decades. The most noticeable difference is between the benchmarks and the alternatives. The two benchmarks show declining receipts over time while the alternatives tend to reflect more stable and increasing receipts. This is mostly related to the differences in their timber harvest schedules and the species mix which comprise them. Both benchmarks schedule the more valuable ponderosa and mixed conifer stands in the early decades in order to meet their sole objective of maximizing present net value. In the fifth decades they are both working primarily with the lower valued lodgepole pine stands. In addition, BM-4 is a departure and its fifth decade harvest is 36 percent of what it scheduled for harvest during the first decade. The alternatives, on the other hand, accelerated the harvesting of lodgepole pine over the next 10 to 30 years in order to address the mountain pine beetle issue. This left them with more of the higher valued ponderosa and mixed conifer stands to be scheduled during the fourth and fifth decades.

The estimated average annual budgets for the alternatives over this same period of time are much more stable, not varying by more than $2.2 million in any alternative for decades 1, 2, or 5. Figure XXXX depicts the average annual first decade budgets by alternative by two cost categories; capital investment, and operations and maintenance. At $25.7 million, BM-4 has the highest budget requirements. This is a 44 percent increase over the Alternative A (Current Direction) budget requirements of $17.8 million (1982 constant dollars). Alternative C has the highest average annual first decade budget amongst the alternatives; $23.5 million or 32 percent above the current funding levels. Alternative G requires the least budget to achieve its management objectives; $16.1 million or 90 percent of the current forest budget. Of these budget estimates, $4.9 million were considered to be fixed, or constant, across all alternatives. The remainder varied by alternative and was a function of specific ouptut levels and the management activities needed to achieve them.

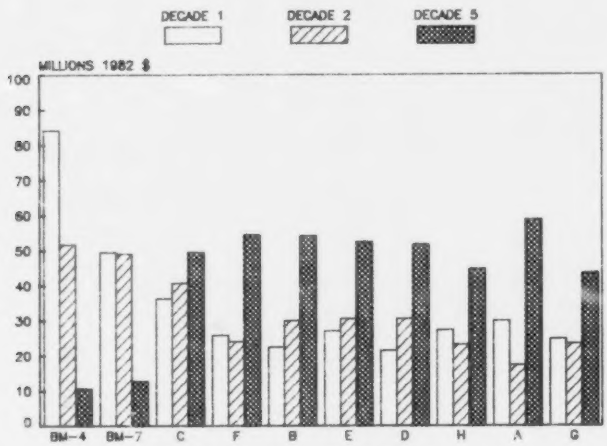

AVERAGE ANNUAL RETURNS TO THE U.S. TREASURY

Figure XXXIX

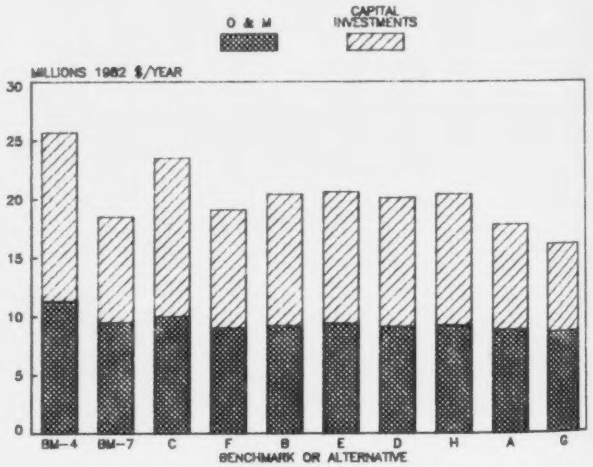

AVERAGE ANNUAL FIRST DECADE BUDGET

Figure XXXX

The majority of the capital investments are for timber management and the Forest road system, with most of it being accounted for by investments in timber production. Most of the Forest transportation network is already in place. None of the alternatives require the construction of new roads in existing roadless areas during the first decade.

Economic Impacts on the Local Communities

Changes in the levels of timber harvests, recreation use, grazing, and Forest Service expenditures on the Deschutes National Forest have the potential to impact the employment and income levels in the local economy. Many of the local communities are particularly dependent upon the forest based timber and recreation resources as the mainstays of their economies. Therefore, the potential economic impacts on the local economy of Central Oregon resulting from the implementation of any one of the alternatives is an important element in the process of selecting a preferred alternative. It was identified as one of the issues, concerns, and opportunities (ICO's) at the outset of the planning process. The following paragraphs present some information regarding this issue.

The primary economic impacts resulting from changes in output levels on the Deschutes National Forest are felt in Deschutes County and small portions of southern Jefferson and northern Klamath Counties. Therefore, Deschutes County will be used as a surrogate for the total area of influence. (For more detail on the economic impact analysis, refer to Appendix B, Section V). However, in recent years more and more communities outside of this traditional area of influence are depending upon the Forest to some extent for their economic well being. For example, up through 1981 approximately 85 percent or more of the timber sold off the Deschutes National Forest was processed in Deschutes, southern Jefferson, and northern Klamath Counties. In 1982 this figure dropped to 78 percent and in 1983 it dropped again to 47 percent. It is primarily lodgepole pine which is being processed outside of the local area. In 1982 and 1983, only 40 percent and 25 percent, respectively, of the lodgepole sold on the Forest was purchased by mills within the traditional local area of influence. As timber supplies in western Oregon and other areas of the State become more restricted due to Wilderness legislation and other land use decisions, buyers are apparently traveling further for their sources of wood.

Figure XXXXI displays the potential first decade economic impacts in terms of jobs and total personal income in the County that could result from the implementation of any one of the alternatives. The alternatives are displayed in order of decreasing PNV from left to right. The impacts are expressed as a percent of the current Deschutes County employment and income base. BM-4 offers the largest potential to provide a stable and growing economy over the next ten years with the opportunity to increase jobs by 13.5 percent and income by 14.1 percent. This is primarily due to its very high average annual first decade timber output levels. Of the alternatives, Alternative C is the only one which provides an opportunity for the local economy to grow in the short term (number of jobs up 3.6 percent, and income up 4.2 percent) based on output levels from the National Forest. The implementation of any of the other alternatives may result in a slight short term downward pressure on both jobs (down from .1 percent for Alternative E (Preferred) to 2.1 percent for Alternative G) and total personal income in the county (down from .1 percent for Alternative E to 2.4 percent for Alternative G).

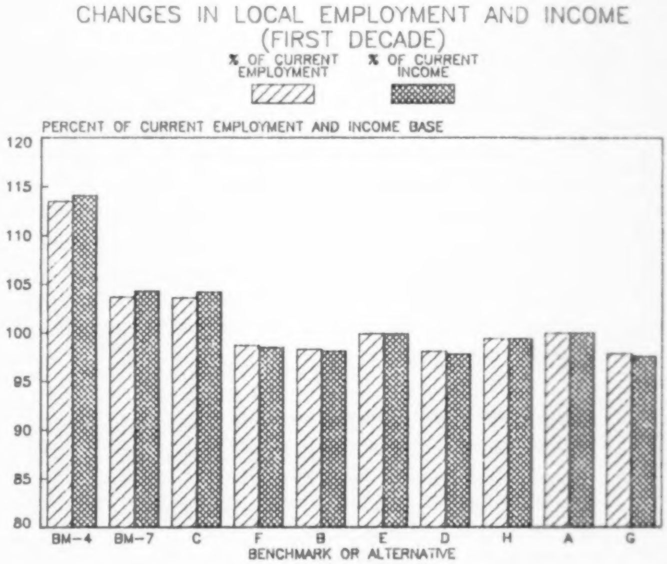


Figure XXXXI

However, and as displayed in Figure XXXXII, in the long term, each alternative provides a resource base from which the local communities can expect to be able to maintain or enhance their economic livelihoods.

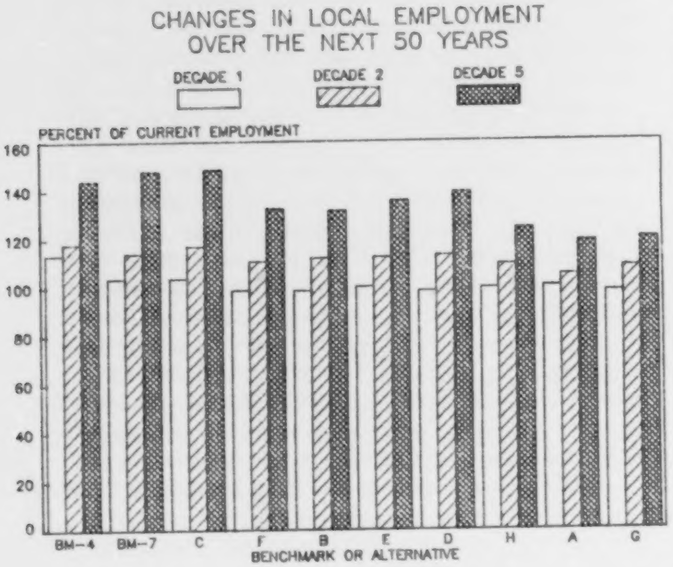


Figure XXXXII

The timber and recreation resources are the primary forest based outputs which are influencing the local economy. Since the recreation use levels will not change that dramatically in the short term from one alternative to another, it is the amount of timber that each alternative proposes to sell which most heavily influences the jobs and income levels during the first decade. Over the longer run (20 to 50 years), the differences between the alternatives in their recreation output levels increase and, therefore, become an important factor in accounting for the variation in potential for long-term economic growth opportunities.

With regard to the timber related impacts, not only is the amount of wood offered for sale an important factor, but so is the species mix. The potential impacts on timber related jobs in the local economy are estimated as a function of the change in the amount of board feet sold by an alternative as compared to current sale levels (as represented by Alternative A [Current Direction]). In terms of cubic feet, Alternative G is the only alternative which proposes to sell significantly less volume than Alternative A. However, in terms of board feet, all alternatives except for the two benchmarks, Alternative C, and Alternative E (Preferred) offer less volume for sale (Refer to Table II-3a for these numerical comparisons). This anomaly occurs because of the relative share of the total timber sale program which is accounted for by lodgepole pine for each alternative. Lodgepole pine is a relatively small tree. Because of this, fewer useable boards can be milled from the cubic feet of wood fiber that exist in its stem than can be recovered from the the same amount of cubic feet from stems of larger trees. Since most of the alternatives consider some form of accelerated lodgepole pine harvest in order to address the mountain pine beetle issue, the proposed cubic feet sale levels are well distributed above and below the current sale program, but most of the board foot levels are down somewhat in the first decade or two.

Two other factors are working to influence the relationship between the proposed timber output levels and their impacts on jobs in the local economy. First, many of the local mills now process small diameter trees in automated low labor intensity facilities. Sometimes the small diameter material is chipped and loaded into trucks right at the sale area. Both of these processing techniques imply that the selling of lodgepole pine will not have strong positive impacts on the wood processing related jobs in the local economy. Secondly and as mentioned above, in 1982 and 1983, only 25 to 40 percent of the lodgepole sold off of the Deschutes National Forest was purchased and processed locally. The bulk of it went to the west side of the Cascades or to southern Klamath County. What this means is that the more an alternative accelerates the harvesting of lodgepole pine during the first two decades and substitutes this volume for the ponderosa pine and mixed conifer species, the less opportunity for the wood processing sectors in the local communities to maintain their current employment base.

Recreation is, and will probably increasingly continue to be, a mainstay of the Central Oregon economy. In 1983, the Deschutes National Forest ranked 5th among the 19 National Forests in the Pacific Northwest Region and 27th among the 125 National Forests in the Nation in terms of visitor days. Most of the Deschutes National Forest visitors, 70 to 80 percent, come from Oregon. The majority of visitors from outside the State originate from California and Washington. Visitors from

Oregon come primarily from three distinct areas: the Portland-Metropolitan area, the Willamette Valley, and Central Oregon. Therefore, the Deschutes National Forest is locally and regionally an important provider of recreation opportunities. Current estimates show the State's population to be increasing at an annual rate of roughly 2 percent. To the extent that an alternative emphasizes the development of capacity for diverse recreation opportunities, recreation use on the Forest is likely to increase at a comparable rate. In accordance, the service industry in the local economy can be expected to grow over the long run to facilitate the recreation visitors, although the jobs will generally be lower paying than the wood processing related manufacturing jobs.

Another means by which the Forest Service can impact the local economy is through its payments to local governments in lieu of taxes. The Forest Service pays 25 percent of its total receipts to county Governments. As was discussed above, most of the Deschutes National Forest receipts are generated by the selling of timber stumpage. To the extent that an alternative emphasizes the production of timber, the local governments will benefit financially. Keep in mind that stumpage receipts are not only related to the amount of volume which an alternative proposes to sell, but also the mix of species. The benchmarks propose to sell relatively more volume of the higher valued ponderosa and mixed conifer species in the early decades, leaving the lower valued lodgepole and mountain hemlock for the later time periods. The alternatives, on the other hand, to varying extents accelerate the harvesting of lodgepole in order to address the pine beetle epidemic. It is because of this that total Forest Service stumpage receipts and payments to counties in lieu of taxes tend to be a little lower than current levels in the first decade for all alternatives except for Alternative C and Alternative E (Preferred). Figure XXXXIII shows the average annual returns which the counties can expect from the implementation of any one alternative in the short and long term.

Summary of Major Tradeoffs Between Alternatives

The following paragraphs summarize the significant tradeoffs between the alternatives. The focus of the discussions is upon the incremental changes in PNV from one alternative to another as influenced by the production of both priced and nonpriced outputs, and more importantly, the ability of the alternatives to address key planning issues, concerns, and opportunities (ICO's). With regards to the ICO's, the summary will emphasize those to which the responsiveness varies significantly between the alternatives and can be indicated quantitatively. Since this discussion is a summary, a more comprehensive understanding of the differences between the alternatives requires the reading of both Chapters II and IV. A more complete description of the ICO's can be found in Chapter I and Appendix A. Finally, Appendix B presents a detailed discussion of the entire Forest Planning analysis process as it relates to addressing the planning issues.

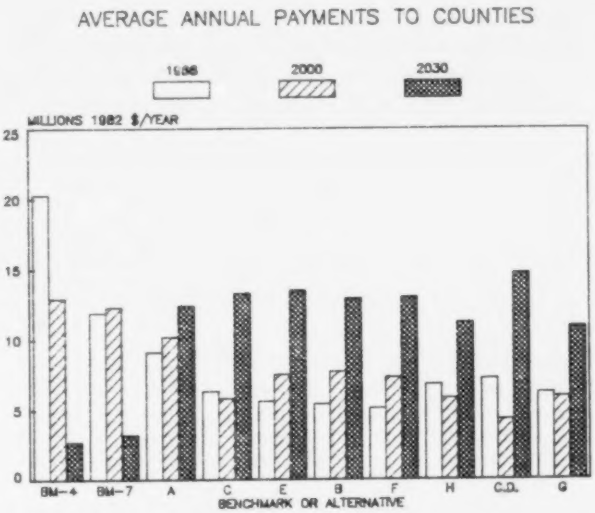


Figure XXXXIII

To provide a framework for assessing these tradeoffs, the ICO's which help to identify the significant differences between the alternatives, and their respective quantifiable indicators of responsiveness are briefly summarized. Then, the quantitative responsiveness of each of the alternatives to these ICO's will be presented in tabular form (Table II-7). Finally, the incremental tradeoffs between alternatives will be sumarized on an alternative by alternative basis in order of decreasing present net value.

National, Regional, and Local Issues

The management of the Deschutes National Forest has implications for national, regional, and local concerns. For example, RPA timber output targets assigned to the Deschutes National Forest reflect the anticipated needs of national and international markets for wood products. The development of geothermal resources on the Forest could have significant implications for national, regional, and local energy needs in the future. Decisions influencing the scenic quality of the Forest and its ability to provide an adequate supply of diverse recreation opportunities is of importance to regional and local residents who are the primary users of the recreation resources on the Forest.

Consequently, the entire Forest Planning process revolves around the development of alternative ways of addressing identified issues, concerns, and opportunities concerning the management of the Deschutes National Forest. In fact, the primary differences between the alternatives is in the way they respond to the ICO's. Appendix A fully discusses each of the 18 ICO's that were identified at the outset of the planning process for the Deschutes. However, while all of the identified ICO's are important, only a subset of them are really useful for distinguishing significant differences between the alternatives. The following is a brief summary of the eight ICO's used to distinguish between the alternatives and their quantitative indicators of responsiveness. Table II-7 displays the quantitative responsiveness to these ICO's by alternative. Also included in Table II-7 is the responsiveness of the alternatives to present net value, annual cash and non-cash benefits which are not specifically identified in the following ICO's but are indicators of interest to the nation.

One ICO that is not displayed in Table II-7 but is useful in evaluating the differences between the Alternatives is "public acceptance". The response to this ICO by the Alternatives is not quantitatively measurable. However, it is likely that the way some ICO's are addressed in some alternatives will cause some conflict and polarization amongst different users of the Forest. Therefore, in the following discussions, public acceptance of an alternative will also need to be considered even though it is not displayed in Table II-7.

Table II-7 Quantitative Indicators of Responsiveness to Issues, Concerns, and Opportunities

Alts. Ranked by Decreasing PNV	PNV ($MM)	Average Annual Net Cash Flow ($MM)		Average Annual Noncash Benefits ($MM)		Response to Issues, Concerns, and Opportunities: Meets or Exceeds RPA Targets							
		Decade 1[1]	Decade 5[2]	Decade 1	Decade 5	Dev. Rec. Target (2,050 MRVD)	Disp. Rec. Target (1,930) MRVD)	Range Target (32 MAUM)	Timber Target (41.9 MMCF)	Timber Target (195 MMBF)	Habitat Improvement Target (6.4 M Acres Equiv.)	Average Annual 1st Decade Revenues To Govt. ($MM)	Average Annual First Decade Budget ($MM)
C	1285.8	12.8	26.7	27.4	54.5	3,493	2,686	45	59.8	265	30.0	36.3	23.5
F	1125.2	6.8	34.4	27.5	45.2	2,638	2,418	29	39.2	174	30.2	25.9	19.1
B	1124.1	2.1	32.2	27.6	44.5	2,567	2,386	32	42.0	176	6.4	22.5	20.4
E	1123.4	6.5	30.7	27.6	47.2	2,770	2,493	32	46.6	202	27.0	27.1	20.6
D	1121.3	1.4	30.1	27.6	49.0	2,963	2,551	29	41.3	171	23.5	21.5	20.1
H	1027.2	7.0	23.3	27.5	40.9	2,310	2,220	32	41.7	187	12.5	27.4	20.4
A	741.3	12.2	39.8	14.5	18.8	1,837	2,036	29	39.6	190	6.2	30.0	17.8
G	661.3	8.7	20.8	14.7	20.6	2,045	2,255	26	32.5	153	16.0	24.8	16.1

[1] First decade basically represents the life of a Plan for any alternative.

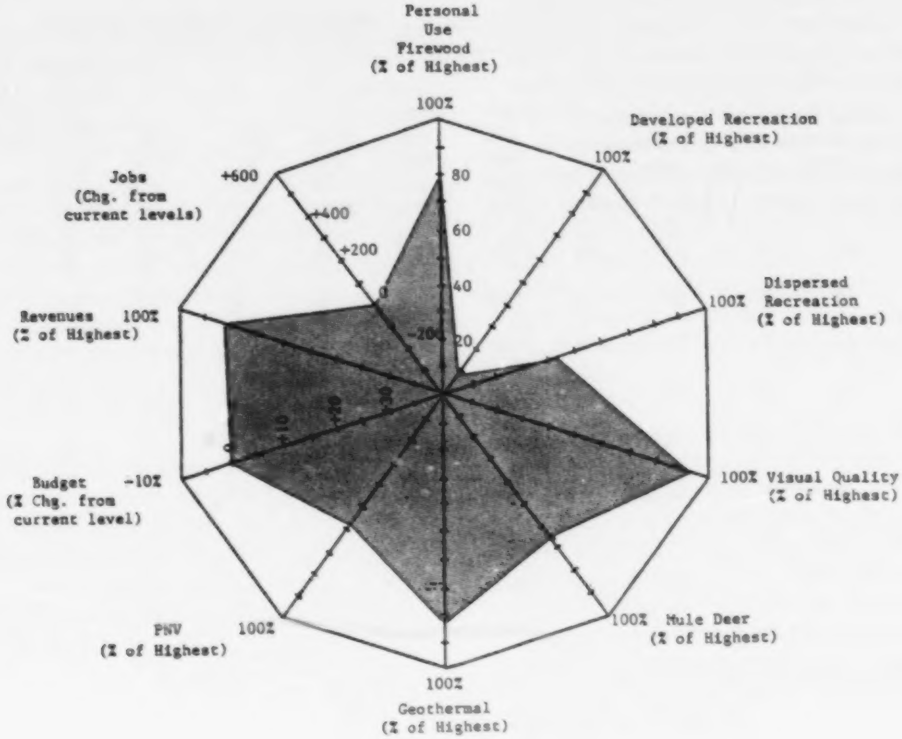
[2] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table II-7 (Continued)

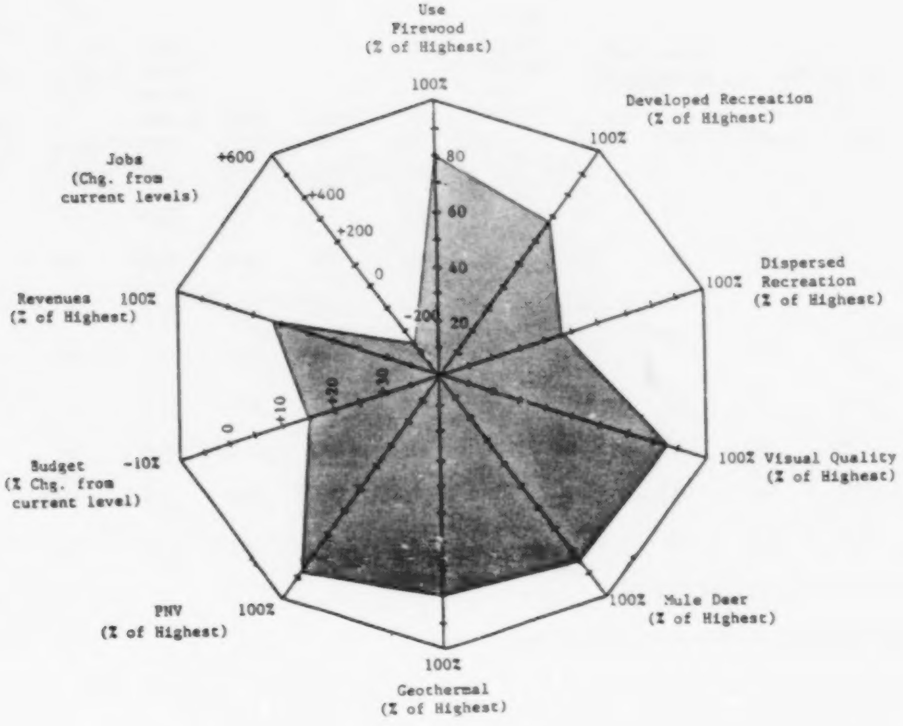
Alts.	PNV ($MM)	Net Cash Flow ($MM)		Average Annual Noncash Benefits ($MM)		Response to Issues, Concerns, and Opportunities							
		Decade[1] 1	Decade[2] 5	Decade 1	Decade 5	Decade 1 Firewood Reserved For Personal Use (M Cords)	Dev. Rec. (M Acres)	Undev. Rec. (M Acres)	Visual Quality (M Acres)	OR Dept. F&W Mule Deer Pop. Objectives (24,850 Deer)	Acres of High Potential Geothermal Avail. For Leasing (M Acres)	Average Annual First Decade Payments to Counties ($MM)	Potential Impact on # of Jobs in Local Economy in 1st Decade (# Changed)
C	1285.8	12.8	26.7	27.4	54.5	0	105.1	1.4	207.4	32,300	126.1	8.7	+550
F	1125.2	6.8	34.4	27.5	45.2	60	74.6	62.8	360.1	27,100	80.3	6.0	-202
B	1124.1	2.1	32.2	27.6	44.5	60	71.8	61.9	365.0	28,600	91.5	5.5	-258
E	1123.4	6.5	30.7	27.6	47.2	60	79.6	94.8	344.6	25,900	100.0	6.8	-21
D	1121.3	1.4	30.1	27.6	49.0	0	98.8	18.2	358.6	29,800	105.0	5.2	-295
H	1027.2	7.0	23.3	27.5	40.9	75	62.1	121.3	411.9	13,300	62.8	6.6	-84
A	741.3	12.2	39.8	14.5	18.8	60	8.9	57.4	401.8	20,300	85.9	7.2	0
G	661.3	8.7	20.8	14.7	20.6	75	57.4	133.7	426.0	16,700	52.8	6.0	-321

[1] First decade basically represents the life of a Plan for any alternative.

[2] The fifth decade represents the potential if an alternative were continued for 5 decades.



ALTERNATIVE A



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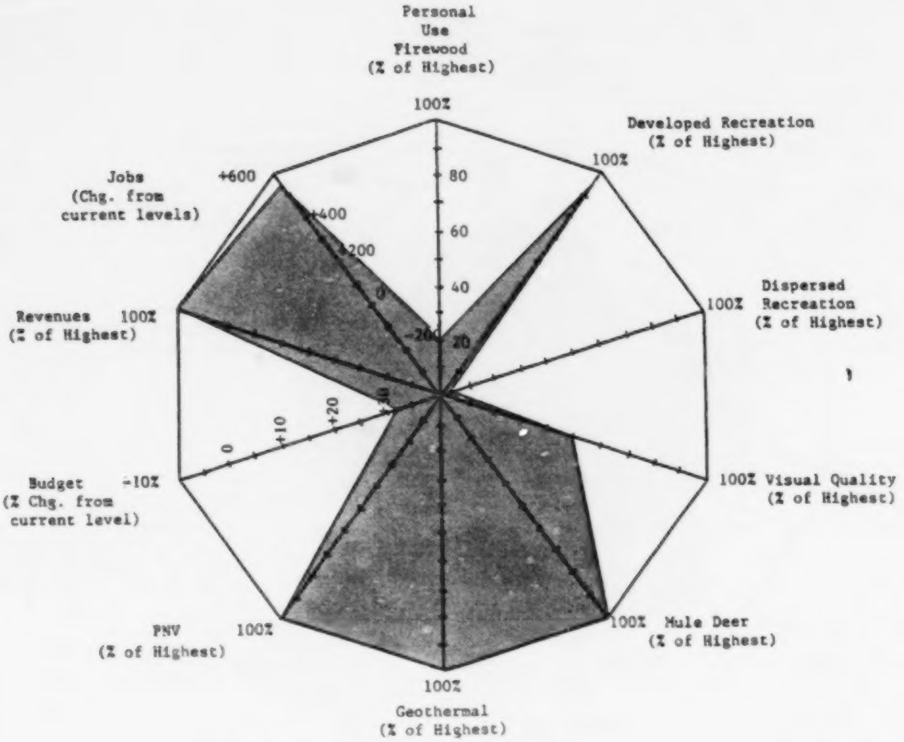

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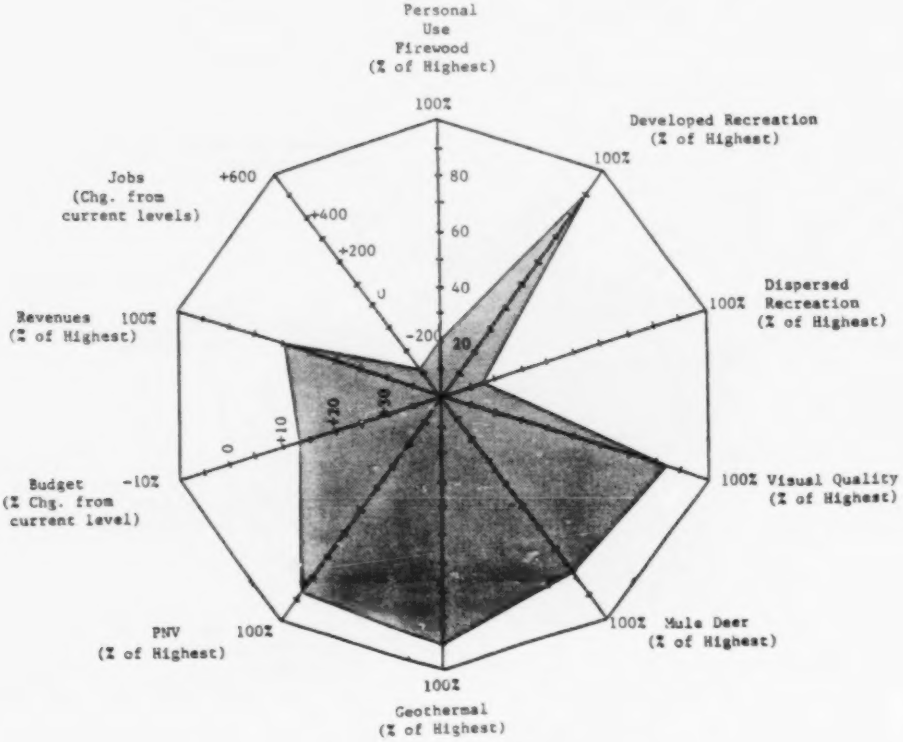

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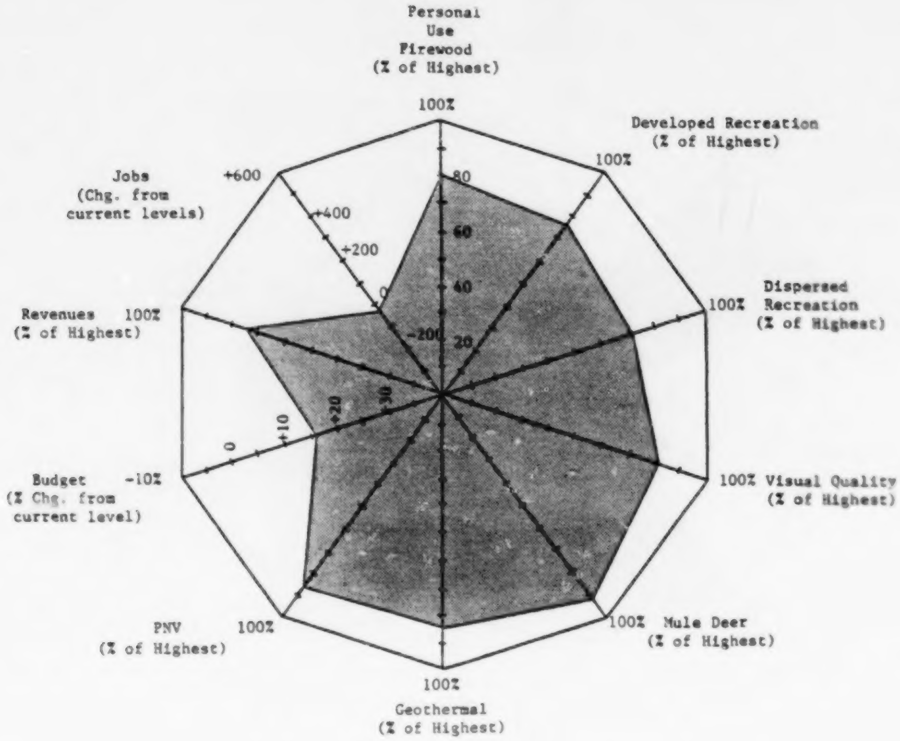

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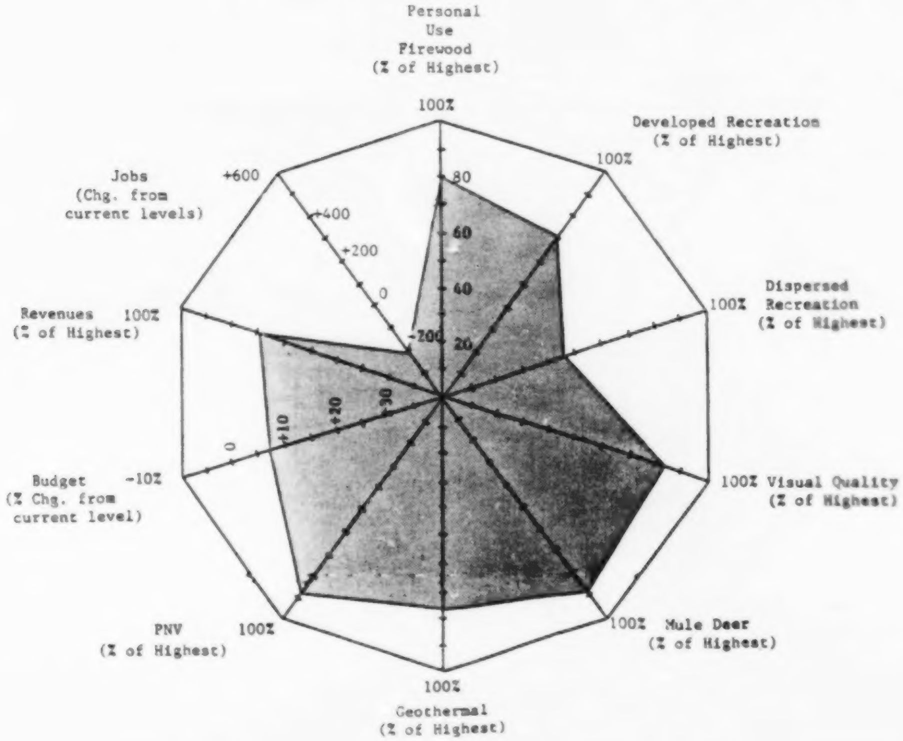

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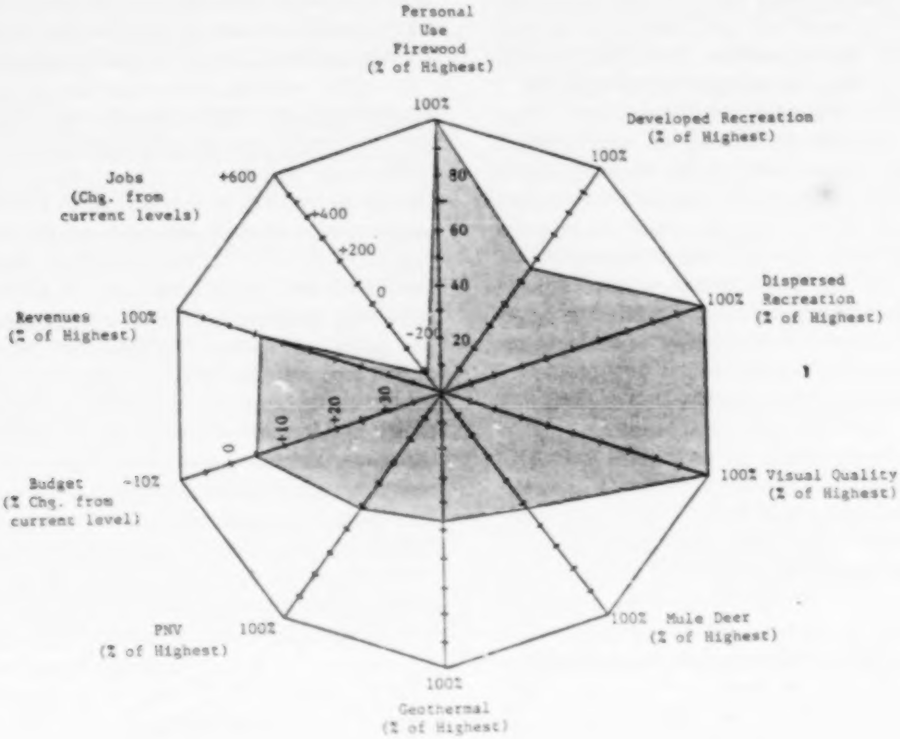
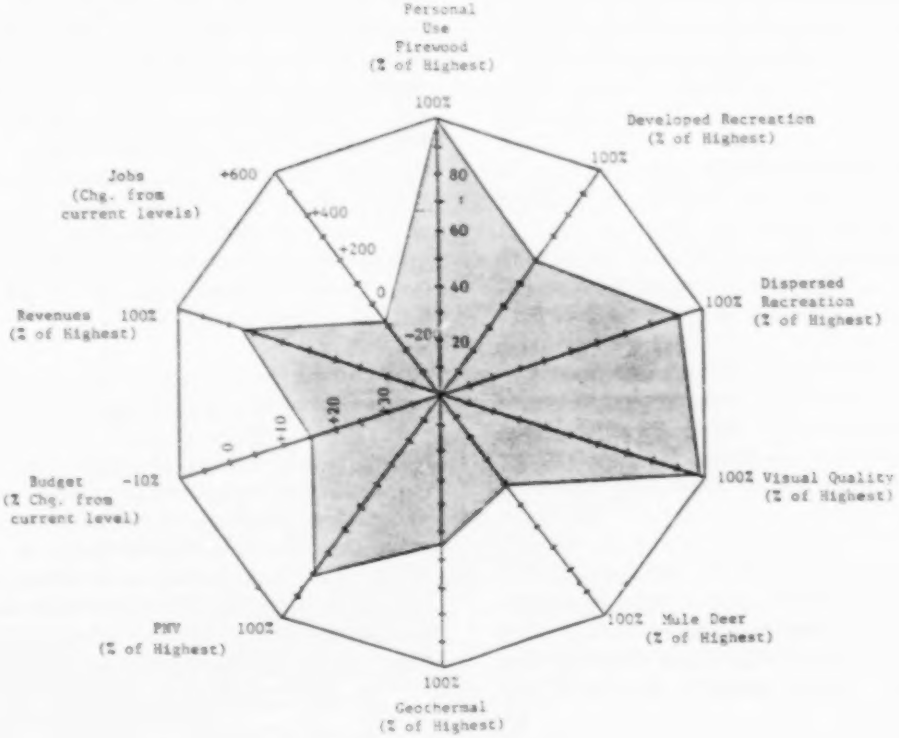


ALTERNATIVE G



ALTERNATIVE H

Can the Forest meet the assigned Resource Planning Act (RPA) Targets?

Based on a National assessment, the RPA planning effort made projections of estimated total national demands for many resources produced on the National Forests. The RPA then assigned each USFS Region in the country a share of the National output targets that would be needed to satisfy anticipated demands for various resources. In turn, the Regional Guide for Oregon and Washington established recreation, range, timber, and wildlife targets for the Deschutes National Forest. The Forest must determine if it is capable of meeting or exceeding these output targets within acceptable environmental limits. The respective first decade RPA targets by resource and the alternatives response to them are displayed in Table II-7.

How should the Forest consider local and regional economies, lifestyles, and population levels in managing Forest lands?

The economy and lifestyles of many local and regional communities are tied to the Forest in many ways. Both tourists and permanent residents are attracted to the wide variety of recreation opportunities available on the Deschutes National Forest. Of the 125 Forests in the National Forests System and the 19 in Oregon and Washington, the Deschutes ranks 27th and 5th respectively in terms of recreation use. Accordingly, the businesses which serve the needs of recreationists and tourists are becoming and will continue to be an increasingly important component of the Central Oregon economy.

The Forest also provides wood for a significant forest products industry in the local communities. In addition, since many people use wood as their primary source of home heating, personal use firewood cutting has become an important element of the Central Oregon way of life.

The resulting consequences of the alternatives to jobs, income, and payments to counties in lieu of taxes are components of this issue. Therefore, the first decade impacts on both jobs and payments to counties in lieu of taxes are displayed by alternative in Table II-7.

Many of the other elements of this issue are couched as individual issues which are discussed below. The way each of the following issues is treated has a bearing on this issue. For example, how the mature lodgepole pine is treated in each alternative affects personal use firewood supplies and the amount of raw materials for the forest products industry, which in turn affects the economies and lifestyles of the Central Oregon Region.

How should the Forest plan to meet future demands for use of wood as an energy source?

Nearly 60 percent of the homes in Central Oregon use wood burning stoves as a source of heat. An estimated 60,000 cords of personal use firewood are harvested and burned annually. In addition, it is estimated that various commercial operations cut and sell an additional 50,000 cords per year. Most of this fuelwood is lodgepole pine. With the combined effects of current levels of personal use firewood consumption, commercial timber sale contracts, and the mountain pine beetle epidemic, the primary source of accessible firewood supplies as we know it today will be gone in 10 to 15 years. An important element of this issue is the amount firewood which will be reserved for personal use as opposed to competitive bidding on an annual basis during the first decade. This is displayed in Table II-7.

How should the Forest provide for present and future developed recreation?

Developed recreation on the Forest takes on many forms ranging from the Mount Bachelor Ski Area to small isolated picnic grounds. Demand for camping, boating, and other recreation pursuits requiring facilities and resulting in concentrations of people is continuing to grow, and, if it parallels the State's population projections, could double within the next 4 to 5 decades. Destination resorts adjacent to the Forest also attract many recreationists to the area. Two questions need to be addressed--which areas should be managed as developed recreation sites and how many acres should they include. The number of acres managed for developed recreation opportunities by alternative are displayed in Table II-7.

How can the Forest keep pace with expanding demands for dispersed recreation?

Hiking, rafting, fishing, snowmobiling, sailing, hunting, driving for pleasure, caving, mountain climbing, and general goofing off are all popular dispersed recreational activities. Some of the recreational activities occur in exclusive areas of the Forest. Others, such as cross country skiing and snowmobiling, occur in the same areas and conflicts can arise. Like developed recreation, demand for these types of recreation activities can be expected to grow, and if it parallels the State's population projections could double within the next 4 to 5 decades. Where and how much of the Forest to provide for dispersed recreation activities while minimizing conflicts is the heart of this issue. Table II-7 displays the number of acres managed for undeveloped recreation opportunities by alternative.

How can the Forest maintain scenic beauty while providing goods and services?

The high recreational values of the Forest are directly linked to its beautiful scenery. Viewing volcanic peaks along the Cascade Crest, large ponderosa pine trees along major roads, and free flowing rivers are all part of the recreation experience. Many people prefer to view natural appearing landscapes rather than ones dominated by timber harvesting activities. The key to this issue is to determine which areas and how many acres should be managed for their scenic beauty. Table II-7 displays the amount of visually sensitive areas of the Forest which are managed to maintain or enhance their visual quality.

What should wildlife populations be?

The public, the Forest, and the Oregon Department of Fish and Wildlife are concerned about several species which are listed below with their currently estimated populations. They are: mule deer (20,300), elk (500 to 700), and osprey (125) pairs. Other species include goshawks, pine martens, and woodpeckers. The question for all the species is what level of emphasis should the Forest place on maintaining or improving habitat for these species? While all of these species are important, we will focus this part of the evaluation on the mule deer populations. The Oregon Department of Fish and Wildlife has established a population objective of 24,850 deer. The habitat capability of each alternative to meet this objective is portrayed in Table II-7.

What areas on the Forest should be made available for geothermal leasing and development?

The Deschutes National Forest is considered to have some of the greatest potential for geothermal resources of any area in the Western United States. Approximately 350,000 acres have already been leased. The Newberry Crater is a designated Known Geothermal Resource Area (KGRA). The interior of the Crater is an important recreation area with two large lakes known for their fishing. Campgrounds and resorts are located adjacent to the lakes. The area is also a popular winter sports area for snowmobiling and cross country skiing. There is an active bald eagle nesting territory within the Crater. Numerous unique geological features, such as obsidian flows, are also found within the Crater. There are also other areas on the Forest which could be leased that are currently not leased. The main thrust of this issue is where and under what conditions should we lease and how should we protect recreation, visual, wildlife, water quality, and other resource values. Table II-7 displays the number of high potential acres by alternative which are available for leasing.

Tradeoffs and Comparisons Between Alternatives

The following paragraphs summarize the tradeoffs between the Alternatives as displayed in Table II-7. The focus is on the incremental changes in PNV from one alternative to another as influenced by the production of both priced and nonpriced outputs, and more importantly, the ability of the alternatives to address the ICO's. The alternatives are discussed in order of decreasing PNV.

Max-PNV (BM-4)

Benchmark-4 and Benchmark-7 are presented here as reference points for present net value comparisons only. While they meet the minimum legal requirements of managing the Forest, they do not represent viable alternatives in that they were not designed to address the ICO's. Since these benchmarks were not designed to address issues, their responsiveness to the ICO's is not displayed in Table II-7. However, some of the other economic implications of these benchmarks are displayed in Tables II-4 through II-6.

Benchmark-4 identifies the maximum present net value of the priced resources on the Forest to be $1501.5 million. The primary emphasis in BM-4 is to maximize the discounted timber and developed recreation benefits from the Forest. To do so, timber harvesting is permitted based on a departure from nondeclining yield. The harvest schedule is permitted to fluctuate by as much as 25 percent from one decade to the next. The harvest age of stands is based on maximizing PNV, which occurs sooner than biological culmination. All roadless areas are available for development. The important developed recreation areas are managed to provide their maximum economic returns. Some timber harvesting is also scheduled in these areas. Any additional dispersed recreation benefits are merely incidental to people living in a roaded forested environment.

Max-PNV (BM-7)

BM-7 provides the second highest PNV ($1420.1 million), a 5.5 percent drop from BM-4. The only difference between BM-7 and BM-4 is in the harvest schedule. In BM-7, timber is scheduled for harvesting on a nondeclining yield basis. In addition, stands must have reached at least 95 percent of biological culmination (CMAI) before they can be considered for harvest. Biological culmination generally occurs 10 to 30 years later than economic culmination at a 4 percent discount rate.

Alternative C

Of all the Alternatives, Alternative C has the highest PNV at $1285.8 million. This is a 14.4 percent drop from the maximum PNV identified in BM-4, and a 9.5 percent drop from BM-7. Alternative C emphasizes the production of priced resources, much like both BM-4 and BM-7. It permits harvest scheduling based on departure from nondeclining yield, but like the other Alternatives, stands must reach 95 percent of biological culmination before being considered for final harvest.

What really differentiates Alternative C from BM-4 and BM-7 is that it is designed to address the ICO's and is an implementable alternative. With regard to the timber program, one of the key differences between Alternative C and the Benchmarks is its aggressive accelerated harvesting of mature lodgepole pine stands in order to address the issue related to the mountain pine beetle epidemic. Over the next 15 years, it proposes to convert about 227,000 acres of mature and overmature natural lodgepole stands to managed plantations. This increase in lodgepole pine volume is in addition to maintaining near historic levels of ponderosa pine and mixed conifer volumes. Consequently, it has the highest first decade harvest of any alternative at 59.8 MMCF/year (compared to 89.0 MMCF/year for BM-4).

Alternative C exceeds all of the range, recreation, timber, and wildlife RPA targets. In doing so, it generates the largest amount of first decade revenues to both federal and local governments of any of the Alternatives. However, this is not without a cost. Alternative C requires the highest budget of all the Alternatives (32 percent more than current funding levels).

Like BM-4 and BM-7, Alternative C also has a strong emphasis for developed recreation benefits. It assigns the most acreage of any alternative to the provision of developed recreation opportunities. However, it provides the least opportunities to meet future needs for dispersed roaded and unroaded recreation.

Alternative C is the most favorable alternative from a geothermal leasing and development standpoint. While this is not reflected in the present net value of the Alternative, this could result in a real economic plus to the local economy sometime in the next 10 to 20 years.

Of all the Alternatives, Alternative C provides for the most opportunity for the mule deer population to increase. In the future this could be translated into more hunting days and, therefore, more hunter expenditures in the local economy.

Alternative C is the strongest Alternative in terms of providing the necessary timber and recreation outputs to support the local employment base and provide opportunity for growth in the future should the demand for forest based resources continue to increase. Other than that, such nonpriced benefits as visual quality, recreation diversity, and easy access to personal use firewood will be at lower standards than today.

Despite its strong economic performance, Alternative C may lead to some conflicts and polarization amongst local communities and other users of the Forest due to its strong commodity development emphasis.

Alternative F

At $1125.2 million, Alternative F has the second highest PNV of the Alternatives. This represents a 12.5 percent drop from Alternative C. Alternative F proposes to harvest timber on a nondeclining yield basis. It has a significantly lower first decade harvest level than Alternative C (39.2 MMCF/year as compared to 59.8 MMCF/year). While some of this is due to harvesting based on nondeclining flow as opposed to Alternative C's departure, another component of the tradeoff is Alternative F's emphasis of the visual resource in sensitive scenic areas. Alternative F also places more emphasis on unroaded nonwilderness recreation and less on developed recreation than does Alternative C. This is also reflected in its lower discounted recreation benefits.

Of all the Alternatives, Alternative F has the highest benefit/cost ratio (3.70:1 as compared to 3.63:1 for

Alternative C which has the second highest). Some of this can be attributed to its more moderate acceleration of lodgepole; it converts 196,000 acres over 20 years. These sales tend to be more expensive and yield lower timber benefits. In turn, it offers relatively high volumes of ponderosa pine which tend to have better returns per dollar invested. Of all the alternatives, Alternative F has the second to lowest timber management, road construction, and organizational support costs. It ranks fourth in total discounted benefits.

Despite its relatively strong performance with regard to economic efficiency, Alternative F falls short of both its range and timber RPA targets. It ranks fourth in terms of cash returns to the government (down 16 percent from current revenues), and has the fifth highest budget requirements (up 7 percent from current funding levels).

While Alternative F provides less developed recreation opportunities than Alternative C, it does offer a more diverse recreation opportunity spectrum through its increased emphasis of dispersed recreation.

Alternative F is considered restrictive in the amount of high potential geothermal acres it opens up for leasing (80.3 M Acres as compared to 126.1 M Acres in Alternative C).

Alternative F may result in some slight downward pressure on employment opportunities, primarily due to its substitution of lodgepole pine for the more labor intensive mixed conifer species. On the other hand, it sets aside 60,000 cords of personal use firewood per year which is a plus with regard to maintaining that aspect of the Central Oregon lifestyle. Visual quality benefits are much higher than Alternative C and only a little lower than the Current Direction (Alternative A). Finally, it exceeds the Department of Fish and Wildlife population targets for deer.

It is anticipated that Alternative F would not cause any significant conflicts or polarization within local communities and other users of the Forest if it were selected as the Preferred Alternative.

Alternative B

The PNV for Alternative B is $1121.3 million, only $1.1 million less than Alternative F. In terms of the emphasis of priced versus nonpriced outputs, Alternatives F and B are similar. Alternative B provides somewhat higher timber benefits due to its departure harvest schedule which allows it to meet the RPA target harvest level of 42.0 MMCF/year. However, these increased timber benefits were equally matched by higher timber management, road construction, and organizational support costs. Its benefit/cost ratio is 3.56:1 as compared to 3.70:1 for Alternative F.

Alternative B meets or exceeds all of the RPA targets. In doing so, it returns 5.5 million dollars to local county governments (seventh highest), and incurs the third highest budget.

While its recreation diversity is similar to Alternative F, Alternative B is more favorable in its flexibility with regard to geothermal leasing. However, its proposed leasing within the Newberry Crater may cause some polarization.

In terms of nonpriced benefits, Alternative B meets or exceeds those provided by Alternative F with regard to personal use firewood and visual quality. Because Alternative B converts 208,000 acres of lodgepole over 15 years, the substitution of the resulting volume for the more labor intensive ponderosa and mixed conifer tree sizes may cause more downward pressure on the employment base in the local economy than does Alternative F.

Alternative E (Preferred)

At $1123.4 million, Alternative E has the fourth highest PNV of all Alternatives, only $.7 million less than Alternative B which has the next highest PNV. Alternative E harvests timber on a departure from nondeclining yield basis and has a first decade annual harvest level of 46.6 MMCF. (Second highest amongst all Alternatives).

Due to its departure harvest schedule, Alternative E meets or exceeds all of the RPA targets. In doing so, it generates the third highest revenues to both federal and local governments. However, it also requires the second highest budget (16 percent higher than current funding levels).

Alternative E, like Alternatives B and F, offers a diverse spectrum of recreation opportunities. It is somewhat stronger in its attempt to provide for unroaded nonwilderness experiences which are becoming one of the limited opportunities on this Forest.

It is the third highest in the amount of acres it permits for geothermal leasing, behind Alternatives C and D.

With regard to nonpriced benefits, Alternative E would maintain the firewood burning aspect of the Central Oregon lifestyle by setting aside 60,000 cords of personal use firewood per year during the first decade. Compared to Alternative B, Alternative E offers slightly fewer benefits pertaining to visual quality. However, it exceeds both the State's targets and Alternative B's output levels for projected mule deer populations. Finally, due to its relatively high first decade timber sale levels, Alternative E provides the resource base to maintain the Central Oregon economy.

Alternative D

Alternative D has the fifth highest PNV of all the Alternatives. At $1121.3 million it is only $2.1 million lower than the PNV of Alternative E. Alternative D schedules timber harvesting on an even flow basis as opposed to Alternative E's departure from nondeclining yield. In fact, the primary reason Alternative E has a higher PNV is because its departure to meet RPA timber targets allowed it to generate $11 million more in discounted timber benefits than Alternative D.

While Alternative D meets or exceeds the recreation and wildlife RPA targets, it falls short with regard to timber and range. Consequently, it ranks seventh in terms of its returns to government (down 40 percent from current returns to Government). It ranks fifth in budgetary requirements, requiring a 13 percent increase above current funding levels.

Alternative D has a relatively strong emphasis toward developed recreation at the expense of dispersed recreation opportunities—particularly unroaded nonwilderness. This results in a less diverse recreation opportunity spectrum than that of Alternative E.

With regard to geothermal leasing opportunities, Alternative D makes available 105 M Acres and is second only to Alternative C.

Alternative D is also more disruptive of the current lifestyles than Alternative E in that it reserves no lodgepole pine for personal use firewood collection. This means the personal use firewood collector will be competing with the commercial firewood purchasers for this resource and probably paying prices commensurate with true market values. Also, because of the lower first decade timber volumes in Alternative D as compared to Alternative E, this alternative will result in more restricted wood processing related job opportunities in the local communities. On the other hand, while both Alternatives have about the same amount of acres meeting the retention and partial retention visual management objectives, Alternative D captures some of the more important sensitive areas through its allocations of land. Finally, Alternative D provides enough mule deer habitat to enable it to exceed the Department of Fish and Wildlife population targets.

Alternative H

Alternative H has a PNV of $1027.2 million, sixth highest of the Alternatives, and $94.1 million lower than Alternative D. Alternative H schedules the harvesting of timber on a departure from nondeclining yield basis in order to maintain current harvest levels on its smaller land base. Its increased harvest levels on the reduced land base causes it to incur the second highest discounted timber management costs of all Alternatives— second only to Alternative C. Also, its $13 million of increased timber investments over Alternative D actually returns $52 million less discounted timber benefits because it is forced to harvest more volumes of lower valued species in decades 2 through 5 in order to compensate for its reduced land base. Alternative H also yields $27.8 million fewer discounted recreation benefits than Alternative D. The decrease in recreation benefits are primarily attributed to its provision of limited capacity for meeting projected future developed recreation needs.

Alternative H meets all of the RPA targets except timber, which it just barely falls short of. Because of its relatively high volume of ponderosa pine during the first decade (second only to Alternative C), Alternative H returns the third highest revenues to federal and local governments in the first decade. However, it also requires the third highest budget (14.6 percent above the current funding levels).

Alternative H offers the second highest emphasis of undeveloped recreation of all the Alternatives, but only at the expense of a rather limiting capacity for future developed recreation needs.

Alternative H is also the second most restrictive alternative with regard to promoting the leasing and future development of the Forest's geothermal resources.

With regard to nonpriced benefits, Alternative H ranks among the highest—possibly second only to Alternative G. Because of its relatively stable first decade timber outputs as compared to the current harvest levels, it causes only a modest downward pressure on the local timber employment base. The downward pressure results because Alternative H substitutes some lodgepole pine for the more labor intensive mixed conifer species offered in the current timber sale program. It also proposes setting aside 75,000 cords of personal use firewood per year which is a plus for maintaining the current lifestyles of Central Oregonians. In addition, it is second in its emphasis towards maintaining and enhancing visual quality on the Forest. On the negative side, it is last in terms of its projected mule deer pupolations and, as a result, fails to meet the States population objectives for this species.

Alternative A (Current Direction)

Of the eight Alternatives, Alternative A ranks seventh in present net value. Its PNV is $741.3 million, $285.9 million below Alternative H. Its low PNV ranking is due to the fact that of all the Alternatives, the recreation benefits generated by Alternative A are the lowest. Its discounted recreation benefits totaled to $343 million as compared to the $707.4 million of Alternative H. There are two reasons for this. First, the existing management plan for expanding intensive recreation capacity is quite restrictive; not allowing enough flexibility to adapt and expand as future demands for developed types of recreation experiences increase. With regard to the projections of future recreation use trends and their associated benefits, this limited capacity for expansion was a ceiling on the amount of developed recreation consumption this Forest could provide.

The second cause is related to the standard of recreation quality which is provided by Altenative A. Two sets of recreation values were used for each type of recreation opportunity provided on the Forest during the development of the benchmarks and Alternatives: standard and less than standard. The standard quality experiences had higher benefits associated with them. They also involved higher capital investment and operations and maintenance costs. On the other hand, the less than standard quality experiences had lower benefits and management costs. The standard recreation experiences return more discounted benefits per dollar invested than do the less than standard. However, it was believed by the ID Team that at current funding levels, the Forest is providing recreation opportunities at the less than standard level of quality. Therefore, the discounted benefits associated with this Alternative are quite lower than the others. In fact, Alternative A and Alternative G have the lowest benefit/cost ratios of all the Alternatives ($2.82 of discounted benefits for each dollar invested). This is primarily due to the low returns associated with dollars invested in less than standard recreation opportunities. Since the timber related benefits for Alternative A rank fifth amongst the Alternatives, some increased investment in managing the recreation resources could enhance the overall PNV ranking of this Alternative.

In addition to its relatively low present net value, Alternative A also fails to meet the developed recreation, range, and timber related RPA targets. Despite this, it results in the second highest payments to counties because of its rich ponderosa pine and mixed conifer species mix during the first decade. It also requires the second lowest funding levels of all the Alternatives.

In addition to ranking fifth in terms of acres available for geothermal leasing opportunities, Alternative A also does not address the Newberry Crater Known Geothermal Resource Area.

In terms of nonpriced benefits, Alternative A ranks quite high. In fact, it serves as the standard with which to compare the other Alternatives with regard to some measures of the nonpriced benefits such as jobs, visual quality, and the abundant supply of personal use firewood. Implementation of this Alternative implies maintaining the status quo as far as the economy is concerned during the first decade, although future decades would witness changes. Alternative A ranks third in the amount of acres it proposes to manage for scenic quality, right behind Alternative H. On the other hand, Alternative A is the sixth lowest of all the Alternatives when it comes to projected mule deer populations, and fails to meet the State's population targets for this species. It also ranks relatively low in terms of both the amount of unroaded recreation and the amount of developed recreation which it provides, thus restricting the diversity of the recreation opportunity spectrum.

Alternative G

At $661.3 million, Alternative G has the lowest PNV of all Alternatives. This is a function of both its relatively low discounted timber and recreation related benefits. The timber benefits are low because Alternative G offers the lowest first decade timber sale program at 32.5 MMCF/year, 6.1 MMCF/year lower than Alternative A and 27.3 MMCF/year lower than Alternative C. The recreation benefits are low because of its relatively low capacity to provide for developed recreation opportunities, and the less than standard quality of recreation opportunities which it is budgeted to manage for. It and Alternative A have the lowest benefit/cost ratios at $2.82 of benefits for each dollar invested. This is primarily due to the low returns generated per dollar of investment in the recreation resource.

Alternative G falls short of the range, developed recreation, and timber RPA targets. Yet, while Alternative G offers the lowest average annual first decade timber sale quantities, its returns to federal and local governments are higher than those of both Alternative B and Alternative D. This is due to its relatively slow conversion of mature lodgepole pine over the next few decades which permits a larger portion of the allowable sale quantity to be composed of the more valuable ponderosa and mixed conifer species. A positive aspect of the finances regarding Alternative G is its budget requirements. It is the only Alternative which proposes a budget lower than current funding levels (a decrease of 10 percent).

Alternative G is the most restrictive of all the Alternatives with regard to providing opportunities for the leasing and possible future development of geothermal resources on the Forest. It is also rather limiting in its provision of opportunities to meet future needs for developed types of recreation activities. Both of these are the result of its strong emphasis towards dispersed recreation and the maintenance of roadless areas in an undeveloped condition. This may lead to some conflict and polarization amongst local communities and other users of the Forest.

In terms of nonpriced benefits, Alternative G ranks highly in all aspects except economic stability in the local communities. Its implementation could result in the most downward pressure on job opportunities and income levels in the local economy. This is primarily due to its low timber sale program. On the other hand, it ranks highest in terms of the amount of personal use firewood available to the citizens of Central Oregon. It also ranks highest with regards to maintaining and enhancing visual quality and providing unroaded nonwilderness recreation opportunities. However, Alternative G falls short of the State's mule deer population targets, proposing lower population levels in the future than currently exist.

Summary of Mitigation Measures

Mitigation of environmental effects are found in Chapter IV, Environmental Consequences. Probable adverse environmental impacts that cannot be avoided, irreversible or irretrievable commitment of resources, and short term use and long-term productivity are discussed. The accompanying Land and Resources Management Plan (the Proposed Forest Plan) details standards and guidelines which also serve as mitigating measures.

CHAPTER III

AFFECTED ENVIRONMENT

Introduction

Though rich in diverse resource opportunities, the Deschutes National Forest is not complex in the biological and physical sense. The terrain is gentle with little potential for mass soil movement. Water quality problems are few. Riparian areas are, for the most part, in good condition. The majority of the transportation system is in place. Options to provide for old growth or provide more intensive timber management are still available.

This section describes the physical, biological, social, and economic components of the environment that would be affected or created by an Alternative, if implemented. Only those aspects of the environment affected by the Alternatives are discussed.

Vegetation

Timber

About 1.15 million acres (approximately 71 percent) of the Deschutes National Forest are classified as "tentatively suitable forest land"—that is, land that is available for timber production purposes. The remaining 29 percent is (1) not suitable or available for timber production (2) non-forest land, i.e., water, rock, sagebrush flats, etc., or (3) occupied by non-commercial tree species, such as western juniper or aspen. In terms of standing volume, the predominant tree species is ponderosa pine. Lodgepole pine, Douglas-fir, white fir, Shasta red fir and mountain hemlock also contribute substantially to the Deschutes National Forest's standing timber volume.

Tables III-1 and III-2 provide estimates of various types of land class acreages, timber type acreages, and standing timber volumes by species groups. It should be noted that the "mixed conifer" category in Table III-2 represents stands which are a mixture of Douglas-fir, and/or true firs, and usually also contain some lodgepole pine, ponderosa pine, and mountain hemlock.

Table III-1 also displays the accounting of acres within the Deschutes National Forest boundary by ownership, forested versus non-forested, and lands suitable for timber harvesting versus non-suitable. In total, there are 1,868.2 thousand acres of land within the Forest boundary. Of these, 1,620.4 thousand are National Forest land. From these, water bodies, non-forested acres, and lands developed for non-forest uses were subtracted in order to arrive at the total 1,367.3 thousand acres of forested lands within the Forest boundary. Finally, 218.6 thousand acres were withdrawn from the suitable and available commercial forest land base either because of their designations as wilderness, research natural areas, experimental forest, or Oregon Cascade Recreation Area, or due to the difficulty and uncertainty of regenerating and growing timber on them. This resulted in a total of 1,148.7 thousand acres of tentatively suitable forested lands on the Deschutes National Forest which were available to prescriptions permitting scheduled timber harvesting during the development of the Alternatives. This compares to the 1,272.0 thousand acres of forested lands determined to be tentatively suitable and available for scheduled timber harvesting under the current Timber Management Plan.

Table III-1 Determination of Lands Suitable for Timber Production (M Acres)

I. Total National Forest Area		1,868.2
A. Less Other Ownerships	247.8	
II. Net National Forest Area		1,620.4
A. Water	36.1	
B. Non-Forest (stocked with less than 10 percent tree cover)	206.4	
C. Developed for non-forest use (crops, improved pasture, residential, administrative areas, improved roads, power-line clearings)	10.6	
Total Non-Forested	253.1	
III. Forested Lands		1,367.3
A. Withdrawn from Timber Production (36 CFR 219.14(a)(4))		
1. Wilderness	59.5	
2. Research Natural Areas and Experimental Forest	12.7	
3. Other (Oregon Cascade Recreation Area)	40.9	
B. Lands Growing less than 20 Ft.3/ac/yr		
1. Lands on which harvest cannot be recovered, i.e., cliffs	0.0	
2. Lands on which further analysis is unnecessary (low site)	18.1	
C. Irreversible Resource Damage (36 CFR 219.14(a)(2))	0.0	
D. Regeneration Difficulty (219.14(a)(3))	87.4	
Total Unsuitable Forested Lands	218.6	
IV. Total Nonsuitable Lands (Both Forested & Non-Forested)		471.7
V. Tentatively Suitable Forest Land		
A. Separate Suitability Component		
1. 20 ft.3	0.0	
2. Regeneration Difficulty	0.0	
B. Regular Component		1,148.7
VI. Total Tentatively Suitable Forest Land		1,148.7[1]
VII. Suitable Land Summary Approved For Forest Planning Prior to Regulations of Sept. 30, 1982, and the Chief's letter of July 15, 1983		1,184.1
VIII. Land Status Under Current TM Plan		1,272.0[2]

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[1] Decrease from pre 1982 acres is primarily due to the Oregon Wilderness Bill of 1984. Calculated by subtracting total unsuitable forested and non-forested lands from net National Forest area.

[2] Lands classified not suited because of regeneration difficulty and the Oregon Wilderness Bill of 1984 account for the reduction from the 1974 TM plan.

In terms of volume, the predominant commercial tree species is ponderosa pine. Other commercially important species include lodgepole pine, Douglas-fir, white fir, grand fir, and Shasta red fir. The volume of mountain hemlock is also significant.

The Forest annually sells 190 MMBF's under the 1978 Land Management Plan. Acres of available timber are shown by species group in Table III-2.

History of Timber Harvesting

Between 1910 and 1945 about 15 to 20 percent of the Deschutes National Forest's "pure" ponderosa pine stands were owned and harvested by private timber companies. Most of these acres consisted of single-storied stands of mature and overmature (300 years and older) ponderosa pine trees averaging 32 to 36 inches diameter breast height (dbh)

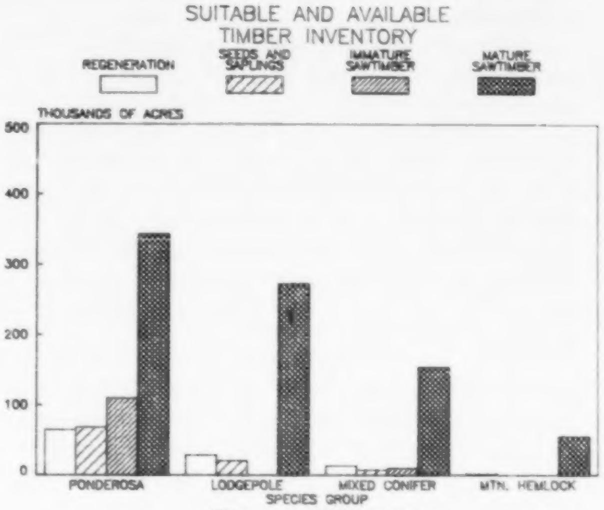

Figure XXXXVI

Table III-2 Tentatively Suitable Timber Inventory, By Species Group

Species Group	**Thousands Of Acres**[1]	**MMCF**[2]	**MMBF**[2]
Ponderosa Pine:			
Regeneration	64.9	--	--
Seeds and Saplings	68.8	--	--
Immature Sawtimber	109.4	182.6	819.2
Mature Sawtimber	341.9	970.1	4946.2
Total	585.0	1152.7	5765.4
Lodgepole Pine:			
Regeneration	28.8	--	--
Seeds and Saplings	20.6	--	--
Mature Sawtimber	272.6	562.4	1835.3
Total	322.0	562.4	1835.3
Mixed Conifer:			
Regeneration	13.3	--	--
Seeds and Saplings	7.6	--	--
Immature Sawtimber	9.9	31.2	145.1
Mature Sawtimber	154.0	628.0	3541.9
Total	184.8	659.2	3687.0
Mountain Hemlock:			
Regeneration	1.8	--	--
Mature Sawtimber	55.1	261.6	1151.0
Total	56.9	261.6	1151.0
TOTAL	**1,148.7**	**2,635.9**	**12,438.7**

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[1] Updated, based on timber sold up through October, 1983.

[2] For live green trees 5" diameter breast high (dbh) and larger. These volumes are estimated for 1990, the midpoint of the first decade.

and 90 to 100 feet in height, with little or no brush or small trees beneath. This was the classic, parklike ponderosa pine forest recorded in old photographs. Model A's wandered throughout the woods without need of a road. Cutting practices in those days amounted to harvesting everything that contained a merchantable log except for the two or three trees per acre legally required to be left as a seed source for a new forest. Trees selected as leave trees were often the poorest quality; but, surprisingly they did regenerate the cut-over areas on short order, and with a healthy stand of young ponderosa pine trees.

Early timber harvesting on Forest Service lands was designed to provide fuelwood and building materials for local residents. By World War II when private timber lands had been largely cut over and demand for lumber jumped sharply, the Forest began to augment the supply of raw materials needed for local milling operations. In the forties and fifties, the location of the Forest's timber sales was determined by the presence of certain species, and by the desire to construct roads into areas previously inaccessible, or accessible only by railroads constructed (and subsequently torn up) by the private timber companies. These areas contained enormous amounts of recently dead, dying, and about-to-die timber. Once in these inaccessible areas, the cutting prescriptions were aimed at harvesting the recently dead and dying trees (salvage) and about-to- die trees ("high-risk"). By the early sixties most areas containing appreciable stands of large sawtimber were accessible by at least a system of main roads. Cutting practices shifted from salvage and sanitation ("high risk") to control of dwarf mistletoe infestations in ponderosa pine and Douglas-fir stands. These cuttings created the first truly managed stands. By the late sixties and early seventies, cutting to control the threat of mountain pine beetle (MPB) depredation got underway--also accelerating the creation of managed stands.

During the 1970's there was a tremendous change in timber management on the Forest. This change was brought about by three practically concurrent factors (1) the increased demand for, and industries' ability to utilize, smaller timber, (2) a dramatic change in the life history of the Forest's lodgepole pine stands, and (3) an explosion of expertise available for forest management. Prior to the decade of the seventies, timber management was carried out by "seat-of-the-pants" foresters and technicians equipped with nothing more sophisticated than aerial photographs, compasses, ribbon, paint guns, and Biltmore sticks. By the end of the decade, a timber management project was most apt to be the result of hours of joint planning by silviculturists, geneticists, wildlife specialists, soils scientists, hydrologists, economists, landscape architects, etc. The result was a management prescription much more sophisticated and scientifically founded and better designed to obtain multiple use objectives. Concrete examples of the benefits of this increased expertise are (1) the Forest's increased survival rate of planted trees (approximately 50 to 70 percent in 1960, 85 to 90 percent in 1980), (2) the designing and execution of a successful Integrated Pest Management program to control a virulent mountain pine beetle epidemic on the Forest which included a very successful public relations and media campaign to gain public understanding and acceptance, and (3) the Santiam Corridor Plan to perpetuate the existence of an old-growth ponderosa pine forest—with increased vista opportunities— between Sisters, Oregon and Suttle Lake. The list of recent successes is quite lengthy and illustrates repeatedly that the quality of timber management over the last 15 years has been demonstrable and gratifying.

By the end of the seventies, advances in logging and milling techniques enabled the profitable use of timber 8 or 9 inches in diameter at breast height. For example, in 1960 the smallest lodgepole pine tree the Forest could market was 12 inches dbh. In the succeeding 20 years, the "merchantable" dbh steadily decreased to the present 8 inches. The recession of the early eighties reduced demand for lumber products. Demand for chip materials, post, and poles has been cyclic, while demand for fuelwood has continued to be strong. The increased demand for smaller trees enabled the Forest to begin seriously managing its vast stands of lodgepole pine.

The increased demand for small saw timber coincided with the rapid increase to epidemic proportions of mountain pine beetle (MPB) activity on the Deschutes. By 1960, most lodgepole pine stands were declining in vigor. This was a prime source of food for the development of MPB populations. By 1979 the problem became (1) salvaging trees killed by the MPB before they became commercially worthless, (2) regenerating a new forest, quickly in the wake of the MPB, and (3) softening as much as possible the adverse effects of MPB activity on other resources, such as aesthetics, wildlife habitat, and recreation. See the Deschutes National Forest Environmental Assessment for Lodgepole Pine Management, 1978, for the particulars of the MPB Integrated Pest Management Program.

The importance of an Integrated Pest Management program may be appreciated by considering that insects and diseases killed approximately 12 million board feet of timber each year between 1968 and 1978. Various species of bark beetles have been the primary cause for approximately two-thirds of the loss.

The mountain pine beetle infestation has been at, or near, epidemic levels on the Forest for about 15 years. Annual lodgepole pine mortality averaged 9.0 million board feet per year from 1969 through 1980. From 1980 through 1984 it is estimated that an additional 155 million board feet of lodgepole pine and 1.5 million board feet of ponderosa pine have been killed by the mountain pine beetle. In 1984, approximately 230,000 acres of the commercial lodgepole pine forest type were infested. Entomologists predict the mountain pine beetle epidemic on the Forest will continue for another 10 to 15 years until the beetles' major food supply of lodgepole pine is either consumed or made unavailable.

As we look ahead into the next decade, we have the opportunity to solve other problems. For example, the Forest is an average producer of timber—as drier, "pine-type" forests go. This averages around 50 to 55 cubic feet per acre per year. The Forest's mountain hemlock stands could produce at greater levels if they could be regenerated at a reasonable cost. Bringing 55,000 acres of potentially highly productive land into production is clearly a challenging management problem.

For timber supply potentials refer to Table II-3c in Chapter II. The market for wood products is undergoing change with the market area expanding. There is a strong demand for ponderosa pine and mixed conifer but demand for lodgepole pine has been cyclic and may continue that way unless new markets develop.

Recent History of Receipts and Costs for the Timber Program

The demand for timber from the Deschutes National Forest is influenced by regional, national, and even international markets for wood products. Consequently, the stumpage prices received for timber sold through the competitive bidding process reflect the species being sold, and the strength of the markets for products which can be manufactured from those species. For example, during the period 1977 through 1982, the average annual high bid values for ponderosa pine ranged from $100 to $302 per thousand board feet. On the other hand, average annual high bid values for lodgepole, the second most common species sold on the Forest, ranged from $24 to $63 per thousand board feet over the same period of time. The fluctuation in prices for any one species over time is heavily influenced by the strength of the building and paper industries, which in turn are affected by the level of interest rates among other things. The differences in stumpage prices between species reflect the variation in final retail values received for products made from those species, and the processing costs involved in making those products. Therefore, it is reasonable to state that the prices bid for stumpage at the time of sale and paid at the time of harvest can be quite volatile, and dependent upon a number of factors not controllable at the Forest level.

Table III-3 displays the receipts for timber volumes harvested on the Deschutes National Forest for the years 1981 through 1985. The timber sale receipts are displayed by the three categories into which they may be distributed. One of these categories is Knutsen-Vandenburg (K.V.) Funds. According to the Knutsen-Vandenberg Act of 1924 and its subsequent amendments, a portion of timber sale receipts (K.V. Funds) may be used to do reforestation work, timber stand improvement , or betterment work for other resources within the area where timber was harvested. During the period from 1981 through 1985, from $3.9 to $7.0 million dollars per year have been designated for this purpose. Another portion of the receipts is used to pay for the construction of roads needed to harvest the timber in a given timber sale area. In many cases, the roads are constructed by the timber purchaser. Often in this situation, the amount of the road construction costs is credited towards the total stumpage costs which the purchaser must pay to the government. Timber sale receipts used for this purpose are referred to as purchaser road credits. Road construction is an investment in the development of the Forest. The roads are used by recreationists, logging traffic for current and future sales, and for purposes of administration and resource protection. The amount allocated to purchaser road credits over the past five years has ranged from $120.0 thousand to $966.8 thousand. The remaining timber sale revenues are returned to the United States Treasury. These are refered to as National Forest Fund (NFF) receipts. As is depicted in the table below, total timber related receipts from the Deschutes N.F. for the the last five years ranged from $13.8 in 1982 to $35.1 millon in 1985. Also displayed in Table III-3 is the total volume harvested on the Forast for each year and the average stumpage receipts per thousand board feet. The lower figures in 1982 reflect the weak market conditions associated with the recession. The receipts generated from timber harvesting in the other years are more typical of non-recessionary activity, although there is probably no such thing as an "average" year since different market conditions are always influencing the timber sales transactions.

In comparison, the cost of administering and implementing the timber sale program over the last five fiscal years has averaged $5.56 million and ranged from $4.63 in 1983 to $7.31 million in 1981. Most of these costs are directly related to the preperation and administration of timber sales, and do not include the costs of implementing cultural treatments for purposes of timber stand improvement. These total costs, and their components are displayed for the years 1981 through 1985 in Table III-4 below. While the amount of dollars spent to administer and implement the timber program do vary with the amount of planned and on going timber management activities, the expenditures are not as variable from one year to the next as are the timber stumpage receipts. This is because stumpage receipts are a function of the volatile markets for finished wood products, while costs reflect salaries and support of an organization geared to meeting the average annual allowable sale quantity, and other ongoing forest management activities such as reforestation and timber stand improvement.

Table III-5 presents a comparison of the total annual timber receipts to total annual timber program costs for the years 1981 through 1985. Generally, it is not appropriate accounting to compare the receipts in any particular year directly to the costs for that year. This is because the incurred costs have little or no relationship to the receipts for a specific year. Timber revenues are received at the time of harvest, which can range from one to five years after the date the sale was sold. On the other hand,

Table III-3 Receipts from Timber Sales (Thousands of Current Dollars)

Year	NFF	K.V	Road Credits	Total Receipts	Volume Cut (MBF)	Receipts Per MBF ($/MBF)
1985	28,000.0	7,000.0	120.0	35,120.0	246,987	142
1984	28,605.5	3,964.8	133.6	32,703.9	244,069	134
1983	23,307.3	5,381.4	342.1	29,030.8	212,288	137
1982	9,405.5	4,270.0	162.4	13,837.9	145,894	95
1981	24,544.9	4,343.1	966.8	29,854.8	193,744	154

Table III-4 Costs of the Timber Program (Thousands of Current Dollars)

Year	Sale Prep. Admin. & Exams	Reforest. & Stand Improvement	Plans & Inventory	Tree Improvement	Total
1985	2,490.0	3,010.9	46.2	200.2	5,747.3
1984	2,430.6	2,758.2	77.0	219.5	5,485.3
1983	2,218.0	2,116.0	90.6	204.6	4,629.2
1982	2,023.7	2,325.1	89.8	206.8	4,645.4
1981	2,229.7	4,778.8	79.3	218.1	7,305.9

TABLE III-5 Comparison of Annual Timber Receipts and Costs (Thousands of Current Dollars)

Year	Total Receipts	Total Costs	Receipts/Costs Ratio
1985	35,120.0	5,747.3	6.11 : 1.00
1984	32,703.9	5,483.3	5.96 : 1.00
1983	29,030.8	4,629.2	6.27 : 1.00
1982	13,837.9	4,645.4	2.98 : 1.00
1981	29,854.8	7,305.9	4.09 : 1.00

timber management costs are incurred either in preparation for future timber sales, administering current ongoing sales, or as investments in future stands once the existing stand is harvested. Nonetheless, a comparison of annual receipts to cost does provide a way of portraying their general relationship. It is evident by examining Table III-5 that the annual receipts from harvesting timber on the Deschutes National Forest exceed the annual costs of administering and implementing the timber sale program by ratios ranging from $2.98 of receipts per $1.00 of costs in 1982, to $6.27 of receipts per $1.00 of costs during 1983. Based upon these comparisons of total receipts to total costs, it is reasonable to conclude that the overall timber program on the Forest generates enough revenues to more than pay for itself. In general, this is true for almost all individual sales on the Forest. Until the summer months of 1985, practically all sales generated revenues which exceeded their direct costs. However, in periods of down markets for wood products, some lodgepole pine sales, and particularly those with relatively large amounts of beetle killed trees, are questionable whether their returns would exceed their costs. Our recent experiences are that these sales aren't bought to begin with, and they have to be reoffered at a later date when the market strengthens.

Plant Communities

Mountain hemlock, alpine, and subalpine plant communities occur in the high elevation and high precipitation zones of the Forest. Mixed conifer and ponderosa pine communities are common to the middle elevation and precipitation zones. Sagebrush, juniper and sparse ponderosa pine communities occur on the semiarid, lower elevations along the eastern edge of the Forest.

Lodgepole pine occurs over a wide range of site conditions and elevations. Mazama pumice deposits, decreasing in particle size and depth north and east from the source, influence the variety and productivity of plant communities. Productivity tends to decrease as the pumice layer becomes deeper. Fifty-five naturally occurring ecoclasses have been mapped over the Forest (excluding Wilderness). Of these, 41 are forested communities and 14 are nonforested.

There are no threatened and endangered plant species on the Forest. There are numerous plants classified as sensitive species which are listed below.

Agoseris elata
Allium campanulatum
Arnica viscosa
Astragalus peckii
Astraglus tegetarioides
Botrychium pumicola
Botrychium simplex
Costilleja chlorotica
Cymopterus bipinnatus
Cypripedium montanum
Draba aureola
Gentiana newberryi
Lobelia dortinanna
Mimulus jepsonii
Penstemon peckii
Ribes irriguum

Forage and Rangelands

The Deschutes National Forest contains 21 commercial cattle allotments and 15 commercial sheep allotments which occupy approximately 719,000 acres (or 44 percent) of the National Forest land. Of that total, approximately 522,000 acres (or 32 percent of the Forest) are usable rangelands. The total carrying capacity of the usable range is 24,175 animal unit months (AUM's) in the cattle allotments and 12,537 AUM's in the sheep allotments.

In addition to the existing allotments there are about 60,000 acres of lands suitable for livestock grazing. These lands could support an estimated 2,000 AUM's. Except for some of the parcels adjacent to the cattle allotments, most of these lands are best suited for sheep grazing.

About 98 percent of the Forest's grazing land is dominated by a tree shrub overstory. The remaining 2 percent are meadows. Annual forage associated with the tree and shrub communities is dry bunchgrass, primarily Idaho fescue and needlegrasses, or various species of sedges. Annual forage production on the dry bunchgrass ranges varies from 50 to 450 pounds per acre. The meadows produce from 500 to 3,400 pounds per acre annually.

Most of the suitable grazing lands are in fair to good condition with a stable or upward trend. Some isolated areas exist within the allotments where the range condition is poor due to overgrazing in the past.

The present demand for livestock grazing has been fairly constant in the cattle industry with most of the cattle allotments being used each year. Demand for sheep allotments is a different story. Since 1978 zero to four of the fifteen allotments have been utilized on a yearly basis.

The total AUM capacity of the Forest, assuming heavy capital investments, is estimated to be 60,000 AUM's. AUM estimates previously stated do not reflect high investment levels. One of the reasons why the Forest does not receive heavy range use and expensive capital investments are necessary to increase AUM's is the lack of water. Most of the livestock water used on existing allotments is hauled by truck to portable water troughs.

There are no known wild horses or burros on the Forest.

Recreation

Forest Setting

The Deschutes National Forest plays a unique role as a recreation provider for Oregon and the Pacific Northwest. Bounded by the crest of the Cascades on the west and the high desert on the east, the Forest offers a wide variety of recreation opportunities. These opportunities include Wilderness, developed ski areas, and developed campgrounds associated with the many lakes, streams, and reservoirs on the Forest. Most of the Forest is also available to dispersed recreation uses such as hunting, fishing, camping, and off-road vehicles.

The Forest's geographic location makes it unique in relation to the major population centers in the Northwest. Situated along the east flanks of the Cascade Mountains, the Forest provides a dry climate for recreation desired by much of the region's population living in the rain belt west of the Cascades. The short driving time—2-4 hours from Eugene, Salem, or Portland, and 7-8 hours from Seattle—make the Forest very accessible both on weekends and for longer vacations.

The Forest is also the primary provider of many forms of outdoor recreation in Central Oregon. The only National Park in the state is located at Crater Lake about 100 miles south of the Forest. The Park has limited camping facilities. Oregon has only a few State Parks east of the Cascades which are usually highly developed campgrounds covering small areas. Three important State Parks in Central Oregon include Cove Palisades State Park on Lake Billy Chinook just north of the Forest, LaPine Recreation Area located on the Deschutes River south of LaPine, and Tumalo State Park on the Deschutes River north of Bend. The Bureau of Land Management, the other major Federal landowner in eastern Oregon, emphasizes dispersed recreation and has only a few developed sites. Deschutes County does not have any recreation sites. The Bend Metro Park and Recreation District has recreation facilities that are oriented to the urban population of Bend.

Several major resorts are located within the Forest boundary and include Sunriver, the Inn of the Seventh Mountain, and Black Butte Ranch. These resorts offer their guests a wide variety of recreation experiences, many of which take place on the Forest.

Many smaller resorts and a few private campgrounds are also available on the Forest. Some of these campgrounds cater to overnight visitors traveling through the area. Others, particularly the membership campgrounds, provide facilities for guests who may spend an entire vacation in the area. These campground users also spend much of their time participating in a variety of recreation activities on the Forest.

Recreation Use

General Use

In 1983, the Deschutes National Forest was ranked 5th among the 19 National Forests in the Pacific Northwest Region, and 27th among 125 Forests nationally in total recreation use. Recreation visitor use for 1984 was 2.6 million visitor days. (A visitor day is a measure of recreation use that represents 12 hours of participation on the Forest. It could be one person for 12 hours or 12 people for only 1 hour each.) The section "Recreation and Tourism Economy" at the end of this chapter is a detailed discussion of the socioeconomic impacts of recreation.

Annual recreation use is recorded by activity type. Table III-6 shows the recreation use during 1984.

Table III-6 Recreation Use by Activity (1984 Figures)[1]

Activity	Use MRVD's[2]	Percent Use
Camping/Picnicking	882.2	33.4
Motorized Travel	532.9	20.2
Winter Sports	339.5	12.8
Water Sports	187.0	7.1
Fishing and Hunting	253.7	9.6
Resorts	90.3	3.4
Organization Camps	50.7	1.9
Recreation Cabin Use	57.0	2.2
Hiking/Horseback Riding	97.9	3.7
Other	151.0	5.7
TOTAL	2642.2	100.0

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[1] 1984 RIM Report Number 2300-1.

[2] The above figures include 80.6 MRVD use on 182,506 acres of Wilderness

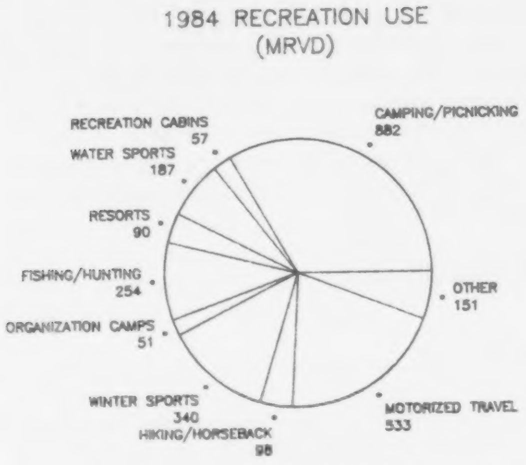

Figure XXXXVII

Developed Recreation

Nearly half of the total recreation use on the Deschutes National Forest is associated with developed recreation sites. Of this use, camping is the most important. The Forest has 101 campgrounds. Forty-four of these receive standard maintenance and a fee is charged for their use. The remaining 57 campgrounds receive a lower standard of maintenance; they often do not have drinking water; and no fees are charged. The use in the fee campgrounds is increasing each year. The average occupancy rate for fee campgrounds in 1984 was 48 percent. This is for a 130 to 150 day season that generally starts with the opening of fishing season in mid-April and ends in mid to late September.

Campgrounds are considered "well managed" when they operate at 20 to 40 percent of capacity, recognizing that capacity may exceed 100 percent on weekends and holidays and early and late season use may be very low. Campground use significantly above 40 percent for the season tends to destroy vegetation in a campground.

In addition to Forest Service campgrounds, there are eight private recreation vehicle parks on the edge of the Forest. Two of these are large membership campgrounds. Four of the resorts on the Forest also have recreation vehicle parks.

Figure XXXXVIII shows that fee campgrounds are currently used above their design capacity and that non-fee campgrounds fall within the desirable use range.

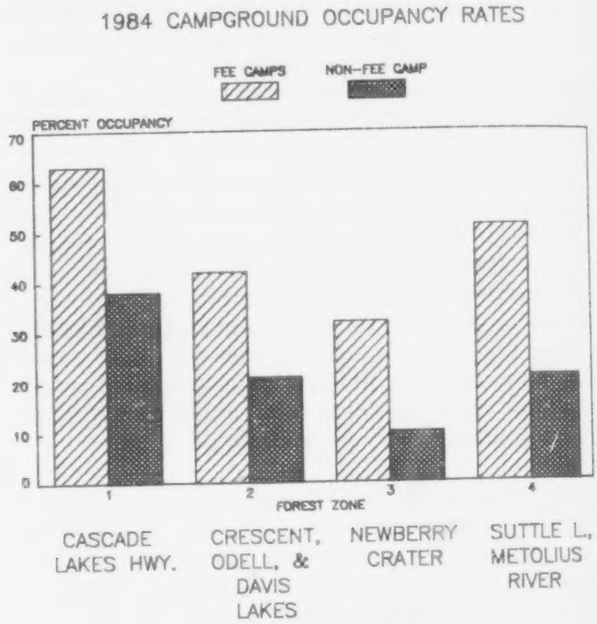

Figure XXXXVIII

The condition of the facilities on developed recreation sites can also influence use patterns. Poor facilities discourage use while heavy use can degrade facilities creating a cyclical use pattern. The "maintenance only" column of Table III-7 shows developed sites in good condition which require only normal maintenance. The second column shows developed recreation sites where major facilities need rehabilitation. The last column shows sites where facilities are in such poor condition that they need to be replaced. Boat sites and the non-fee campgrounds occur most frequently in this last category.

Clearly, additional fee camping sites are needed to meet existing and future demand. There are several ways this demand could be met. Some options would include:

Expanding existing fee campgrounds,

Building new campgrounds,

Upgrading reduced service level campgrounds to fee campgrounds,

Expanding recreation vehicle parks at resorts on the Forest,

Adding recreation vehicle parks at other resorts,

Converting some resorts entirely to recreation vehicle parks,

Encouraging new campgrounds off the Forest,

Permitting new campgrounds on the Forest to be built with private funds.

Table III-7 Condition of Developed Sites[1]

			Site Condition		
Site	**Number of Sites**	**PAOT[2]**	**Maint. Only**	**Major Fac. Need Rehab.**	**Major Fac. Need Replaced**
Observation	13	590	6	3	4
Boating	51	2,873	20	12	19
Swimming	8	850	7		1
Trailheads	25	1,580	19	2	4
Campgrounds					
Fee	44	6,780	26	9	9
Non Fee	57	4,320	14	8	35
Picnic Grounds	31	1,170	25	0	6
Winter Sports	11	1,055	10	0	1
Interpretive	10	1,010	9	0	1
TOTAL	**250**	**20,228**	**136**	**34**	**80**

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[1] 1984 RIM Facility Condition Report Number 2300-6.

[2] PAOT =People at one Time Capacity

Interpretive Service facilities such as visitor information centers are another major component of the Developed Recreation Program. At the core of the program is the Lava Lands Visitor Information Center located at the base of Lava Butte about 10 miles south of Bend. The volcanic story of Central Oregon is the general interpretive theme of the Center. Travel information and interpretation also describes various points of interest in the Forest and Central Oregon. Interpretive trails near the Center explore the rugged lava flow and surrounding forest lands.

A short 1.5 mile drive leads from the Center to the top of Lava Butte--a classic breached cinder cone. At the summit, the Lava Butte Observatory offers further interpretation of the geology as well as a panoramic view of the Cascade Mountain Range and Deschutes Plateau.

Closely associated with Lava Lands is Lava River Cave, one mile to the south. This mile-long lava tube is the longest in Oregon.

Lava Lands, Lava Butte, and Lava River Cave receive a combined total of about 250,000 visitors per year. The season of operation generally runs from May through October.

Another major Developed Recreation attraction on the Forest is the Mt. Bachelor Ski Area. Over half a million people visit the area each year, making it the largest ski area in the Northwest and one of the largest in the country. Skiing starts in November and continues through July. The Summit Lift continues to operate through Labor Day for sightseers. The area has nine chairlifts that provide over 3,000 vertical feet of skiing for alpine skiers. The area also offers over 25 kilometers of nordic skiing.

The Area has an approved Master Plan[1] which allows for increasing capacity from its present capacity of approximately 12,000 skiers at one time to 23,000 skiers at one time. This plan calls for future development to maintain the "Mt. Bachelor experience," which is generally low density skiing in a natural environment.

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[1] Mt. Bachelor Recreation Area Proposed Master Plan, March 1, 1980.

Mt. Bachelor is a major contributor to the tourism economy of Bend and Deschutes County. (See Recreation and Tourism Economy, at the end of this section).

Dispersed Recreation

Dispersed recreation occurs outside of developed recreation areas such as campgrounds. Camping in Wilderness and unroaded areas, is considered dispersed recreation. Also, the extensive road system on the Forest has created many dispersed sites along lakes and streams accessible to the fishermen who prefer not to camp in developed campgrounds. The same roads have also opened up many areas for hunter camps.

The 1979 Code-a-Site Inventory of non-maintained campsites and recreation areas gives information on utilization patterns and condition of dispersed recreation areas. These were evaluated in terms of resource impact occurring as a result of recreation use. Sixty percent of these were receiving "low" levels of resource impact; 20 percent were receiving "acceptable" or "normal" impact; the remaining 20 percent were receiving use that resulted in site deterioration. Two percent of this total is considered "severe impact", most of which occurs at especially attractive sites in Wilderness areas. These heavily used sites indicate that some areas are being used to capacity. However, the large number of sites in the low impact category indicates the total dispersed recreation resource is utilized well below resource capacity.

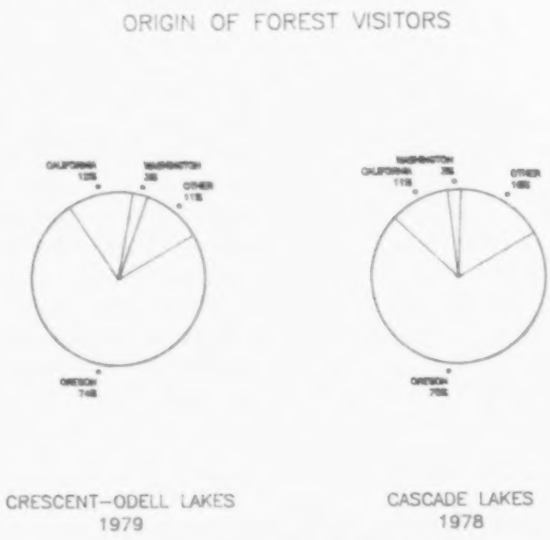

Figure XXXXIX

Origin of Visitors

Campgrounds

Table III-8 shows use patterns on two popular areas of the Forest.

Table III-8 Origin of Forest Visitors by State (in percent)[1]

Origin	Crescent-Odell Lakes (1979)	Cascade Lakes (1978)
Oregon	73.78	70.36
California	12.34	11.02
Washington	2.85	2.53
Others and Foreign	11.03	16.09
TOTAL	100.00	100.00

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[1] RIM-RECZIP Sampling Program

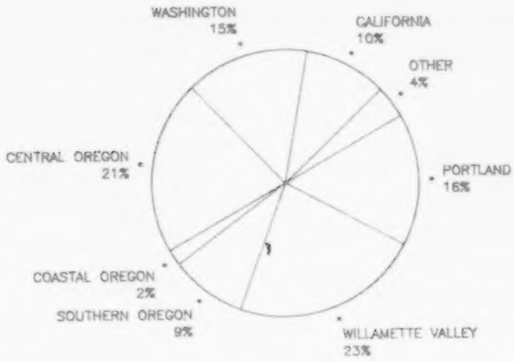
Mt. Bachelor Ski Area

A sample of visitors at Mount Bachelor Ski Area shown in Table III-9 reveals a similar pattern.

Table III-9 Origin of Visitors to Mt. Bachelor Ski Area[1]

Origin	% of Visitors 1984-85	
Oregon:		62.0
Portland	24.0	
Willamette Valley	16.0	
Southern Oregon	5.0	
Coastal Oregon	2.0	
Central Oregon	15.0	
Washington		14.5
California		16.5
Other		7.0
TOTAL		100.0

ORIGIN OF VISITORS TO MT. BACHELOR SKI AREA



BASED ON 1978–79 SEASON

Figure L

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[1] Mt. Bachelor Ski Area Survey, Summary as of 4/8/85

Lava Lands Visitor Center

Table III-10 shows the origin of visitors for 1984 at Lava Lands.

Table III-10 Origin of Forest Visitors to Lava Lands[1]

	% of Visitors
Oregon	39.0
California	18.2
Washington	15.5
Other States	20.5
Foreign Countries	6.8
Total	**100.0**

---

[1] Information from guest register at Lava Lands.

Wilderness Use

Wilderness use is similar to campground use but a significantly higher percentage (92 percent) of Wilderness users are from Oregon. See Table III-11.

In summary, 70 to 80 percent of the visitors to the Deschutes National Forest come from Oregon. Visitors from Oregon come from three distinct areas: Portland-Metropolitan area, the Willamette Valley, and central Oregon. The majority of other visitors are from California and Washington. This information shows that the Deschutes National Forest is regionally an important provider of recreation opportunities.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act recognizes three potential classifications: wild, scenic, and recreational. Four rivers on the Deschutes National Forest (Figure LI) are identified as potential candidates for the National Wild and Scenic Rivers System. Table III-12 charts the river classifications and number of miles considered.

Table III-11 Origin of Visitors to Wilderness Areas[1]

Influence Area	Portland Metro	Salem/ North. Will-Valley	Eugene/ Spring-field	Central Oregon	All Other Ore.	Cal. State	Wash. State	Other USA & Foreign	Total
Wilderness	% Total	% Total	% Total	% Total	% Total	% Total	% Total	% Total	Total
Mt. Jefferson	24.2	42.8	9.4	6.6	11.0	1.8	1.3	3.0	100
Mt. Washington	13.8	19.9	42.0	7.9	6.9	3.6	1.4	4.5	100
Three Sisters	14.2	14.2	33.5	15.9	13.9	3.0	2.0	3.3	100
Diamond Peak	6.3	6.8	65.1	1.8	9.5	4.1	1.0	5.4	100
All	18.0	26.1	25.5	10.9	11.9	2.6	1.6	3.4	100

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[1] Analysis of Wilderness Permits 1978. (Does not include data for Mt. Thielsen Wilderness which was created in 1984.)

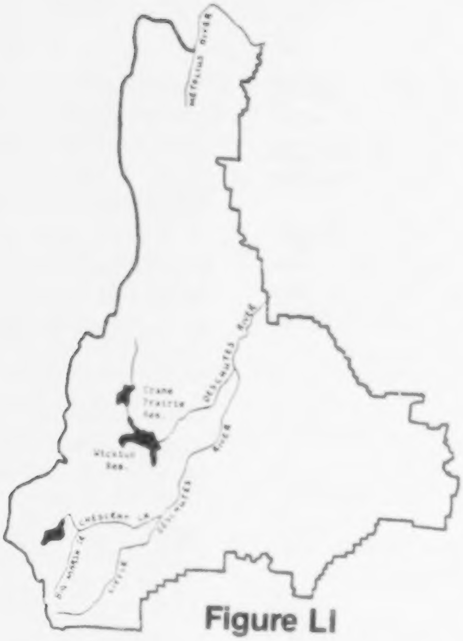

Figure LI

Table III-12 Inventoried Wild and Scenic Rivers[1]

River	Portion on Deschutes National Forest	Miles
Big Marsh-Crescent Creek	Entire length	41
Deschutes River	Wickiup Reservoir downstream to 2 miles south of Bend	53
Little Deschutes River	Entire length	97
Metolius River	Source downstream to Lake Billy Chinook	29

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[1] "Nationwide Rivers Inventory: A Report on Natural and Free-Flowing Rivers in the Northwestern United States," August 1980 by the Heritage Conservation Recreation Service [HCRS]). Also ("The Nationwide Rivers Inventory," January 1982 by the National Park Service.)

Special Interest Areas

Table III-13 shows the three special interest areas which are currently designated by the Regional Forester and those that have potential for designation.

Table III-13 Designated and Potential Special Interest Areas

Area	Type	Acres	Status
Lava Cast Forest	Geologic	3,982	Designated
Lava Butte	Geologic	7,269	Designated
Lavacicle Cave	Geologic	40	Designated
Katati Butte	Geologic	93	Potential
Big Hole	Geologic	741	Potential
Hole-in-the-Ground	Geologic	602	Potential
Newberry Crater	Geologic/ Archaeological	15,973	Potential
Castle Rocks	Geologic	232	Potential
Balancing Rocks	Geologic	42	Potential
Horn-of-the-Metolius	Scenic	1,528	Potential
Hosmer Lake	Biologic	93	Potential
Wake Butte	Geologic	602	Potential

Trails

The Deschutes National Forest has a large trail program designed to meet the needs of many different users. Some trails are designed for hikers only while others are designed for mixed uses, such as horses and hikers. Some trails are designed as both summer hiking trails and winter snowmobile or nordic ski trails. Finally, some winter trails are located on roads. Table III-14 lists trail miles by design type.

Table III-14 Miles of Trail by Design Type

Design Type	Miles
Hiker	44.70
Hiker Ski	3.20
Horse Hiker	509.48
Horse Hiker Ski	26.60
Horse Hiker Snowmobile	29.50
Road Ski	39.80
Road Snowmobile	293.25
Road Snowmobile Ski	6.20
Ski	45.70
Snowmobile	17.60
Total	**1,016.03**

About 259.5 miles of trail are in Wilderness, 461.8 miles are winter trails, and 66 miles are part of the Pacific Crest National Scenic Trail.

Most of the hiker and horse trail system on the Forest is completed. About 9.3 miles of new trail needs to be constructed to tie the existing system together. In addition, 83.6 miles of this system need to be reconstructed to avoid areas where the trails are damaged or to improve the quality of the experience.

There is much greater need for additional winter trails, particularly Nordic trails, than there is for summer trails. The Nordic Program is increasing more rapidly than any other part of the trail program.

Two new trail needs that have not been addressed are mountain bicycles and the all terrain vehicles (ATV's). This use has increased rapidly in the last few years, and it is expected to grow in the future. There is ample opportunity to accommodate these new trail uses on the Forest, but it will require careful planning to avoid conflicts with other users.

Off Road Vehicles (ORV's)

Most of the Forest is open to Off Road Vehicles (ORV's) in the summer. Exceptions are Wilderness areas, Research Natural Areas, and the Experimental Forest.

In the winter, the Forest has some of the best snowmobiling in the State. Some 346 miles of snowmobile trails are currently available; 261 of these miles are groomed. Many of these trails lead to open areas used extensively as snowmobile play areas. Total snowmobile use amounts to about 50,000 visitor days annually.

During the summer, ORV use has not been significant until recently with the advent of 3-wheel or 4-wheel all-terrain vehicles. The potential for this type of use on the Forest is tremendous due to the Forest's comparatively gentle and accessible terrain.

The Forest also permits several motorcycle and 4-wheel drive vehicle races on the desert fringe each year. These races have up to 500 racers and several thousand spectators. Environmental damage is minimal and conditions are ideal for the racers. The demand for this type of event exceeds the Forest's ability to administer them, so the number of races has been limited to four each year.

Projected Use

The majority of Forest recreation users are from Oregon but people from California and Washington are also important Forest users. The population of Oregon is expected to increase approximately 2 percent annually which forms the basis for most long range recreation growth projections.

Recreation Special Uses

Private enterprise plays an important role by providing some recreational services on the Forest. Private individuals and organizations operate under special-use permits issued by the Forest and remit a fee to the Government based on their annual revenues. Permits are issued only to meet a demonstrated public need for a service that can best be provided by the private sector. They are not issued simply to provide an economic opportunity for the vendors.

In 1984, 87 recreation special-use permits were issued for a variety of commercial operations. These permits include: one ski area, 4 youth camps, 13 resorts, one store, 21 recreation events, 27 outfitters and guides, and several others. The outfitter and guide permits include canoeing and rafting on the Deschutes River, horseback riding at various resorts, educational programs conducted by Central Oregon Community College, and Wilderness outfitters. Special events range from motorcycle races on the eastern fringe of the Forest to a Triathalon along the Cascade Lakes Highway.

Recreation Inventories

Recreation Opportunity Spectrum (ROS)

In order to identify the recreation resource environment, the entire Forest is classified into various categories according to the Recreation Opportunity Spectrum (ROS).[2] The ROS correlates various kinds of recreation experiences with specific forest environmental settings to form an "opportunity spectrum."

ROS spectrum categories range from primitive to urban and describe a range of recreation situations a visitor can experience in an undisturbed, natural environment with little to no contact with other humans to a highly modified, altered environment with significant contacts with others. In addition to the six ROS spectrum categories identified in the National System, Roaded- Modified[3] and Semiprimitive Motorized Winter Only categories have been added. Each ROS category is described below and the inventoried acres in each category are shown in Table III-15.

Primitive - These areas provide the opportunity for users to experience a very high degree of solitude and isolation from the sights and sounds of human activity in an environment that is essentially unmodified. All of these areas occur within existing Wilderness.

Semiprimitive Nonmotorized - These areas are the same as "Primitive" areas except there may be very subtle alterations. These areas occur within existing Wilderness and roadless areas.

Semiprimitive Motorized, Winter Only - These areas are the same as "Semiprimitive Nonmotorized" except they are open to snowmobiles and over the snow vehicles in winter.

Semiprimitive Motorized - These areas provide the opportunity for users to experience a high to moderate degree of isolation from the sights and sounds of humans, in a setting where the natural landscape may have moderately dominant alterations when viewed from within the area. Areas appear more natural when viewed from the relatively low standard roads that go through the area.

Roaded Natural - These areas provide the opportunity for users to experience a moderate degree of isolation from the sights and sounds of humans in an environment that is primarily natural appearing but accessible by passenger cars.

Roaded Modified - The experience of the user is similar to Roaded Natural, but the setting is heavily modified by human activity. Access is generally easy for passenger cars. This category is typical of much of the Forest that has heavy timber sale activity.

Rural - These areas are often the settings between the cities and the forests. These areas may include large well developed campgrounds, ski areas, and other facilities that cater to large numbers of people and provide a high level of facilities.

Urban - These areas are dominated by buildings and people. Recreation areas include city parks, large resorts, or winter sports complexes.

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[2] "Recreation Opportunity Planning Guidelines for Land and Resource Management Planning" (December 1979).

[3] Bacon, Warren R. The Recreation Opportunity Spectrum - Something Missing?. April 1982.

Table III-15 Acreages By Recreation Opportunity Spectrum Category[1]

	Total Forest		Portions Within Wilderness	
Category	**Acres**	**% Total Acres**	**Acres**	**% Total Acres**
Primitive	71,532	4	71,532	4
Semiprimitive, Nonmotorized	124,208	8	111,974	7
Semiprimitive, Motorized, Winter Only	144,830	9	0	0
Semiprimitive, Motorized	17,823	1	0	0
Roaded, Natural	223,735	14	0	0
Roaded, Modified	894,893	55	0	0
Rural	133,503	8	0	0
Urban	9,888	1	0	0
TOTAL	**1,620,412**	**100**	**182,506**	**11**

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[1] Forest R2 Map Inventory.

Visual Quality

The Deschutes National Forest is regionally known for its scenic beauty. Past land management activities have not extensively disturbed this resource. Approximately 92 percent of the Forest viewed by the traveling and recreating public appears unchanged from its natural condition.

The visual resource has been inventoried in order to develop Visual Quality Objectives (VQO's). These are suggested Forest management standards which protect and maintain visual quality. The classifications measure, in relative degrees, deviation from a natural-appearing landscape. The categories of visual quality are defined as follows:

Preservation - Only ecological changes are evident.

Retention - Human activities are not evident to the casual Forest visitor.

Partial Retention - Human activity may be evident but must remain subordinate to the characteristic landscape.

Modification - Human activity dominates the landscape but follows naturally established form, line, color, and texture. It appears as a natural occurrence when viewed in the foreground or middleground.

Maximum Modification - Human activity dominates the landscape but appears as a natural occurrence when viewed in the background.

Table III-16 and Figure LII below shows how the Forest is classified according to these Visual Quality Objectives.

Table III-16 Inventoried Visual Quality Objectives[1]

Visual Quality Objective	Acres	Percent of Forest
Preservation	210,654	13
Retention	243,062	15
Partial Retention	550,940	34
Modification and Maximum Modification	615,756	38
Total	1,620,412	100

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[1] 1982 VQO of the Deschutes National Forest.

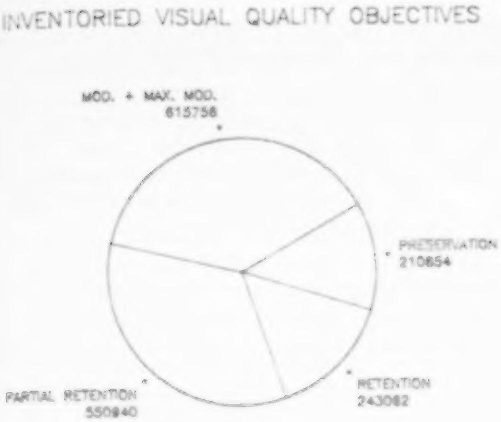

Figure LII

Roadless Areas

The Oregon Wilderness Act of 1984 added 59,265 acres of roadless areas to three existing Wildernesses. It also created the 6859 acre Mt. Thielsen Wilderness from the Windigo-Thielsen roadless area on the Deschutes. The Oregon Cascade Recreation Area (OCRA) was also created from 37,891 acres of roadless land and 4765 acres that was not in any roadless area.

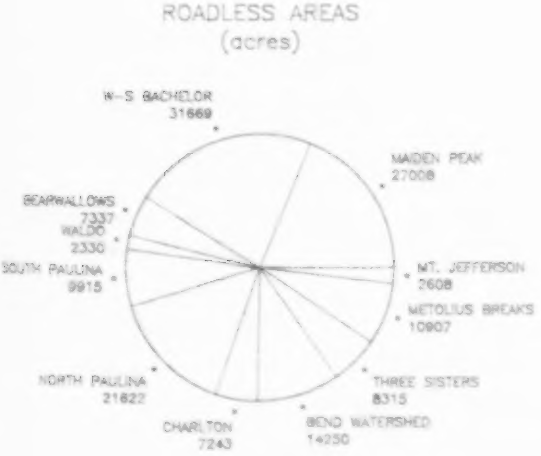

Figure LIII

The remaining acres of each Roadless Area are listed in Table III-17.

Wilderness/OCRA

Parts of five Wildernesses and one Congressionally designated Recreation Area are located on the Forest. Acres are shown below in Table III-18.

Table III-18 Acres in Wilderness and the OCRA

Wilderness Area	Acres
Mt. Jefferson	32,734
Mt. Washington	15,206
Three Sisters	94,247
Diamond Peak	34,000
Mt. Thielsen	6,859
Oregon Cascades Recreation Area	42,656
Total	**225,702**

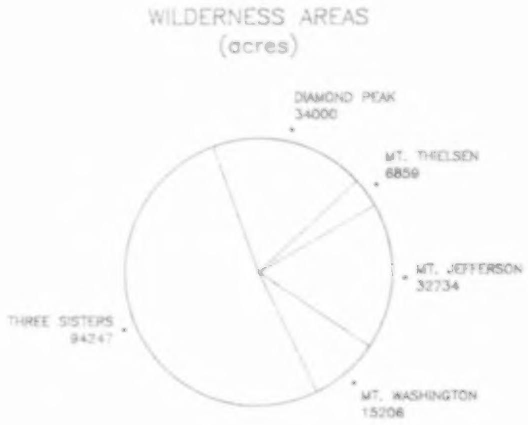

Figure LIV

Recreation and Tourism Economy

Recreation and tourism have become the largest segment of the economy in Deschutes County with a direct income for 1983 of $225 million.[4] This includes estimates for both in-State and out-of-State tourists who visited Deschutes County during the year. Tourism and recreation visitors, and their expenditures have continued to increase for many years. In fact, annual expenditures increased 86 percent during the three year period from 1980 through 1983. During the same period, the number of visitors increased 18 percent. There is no evidence

Table III-17 Remaining Roadless Area Acres

RARE II Number	Roadless Area	Net RARE II Acres	New Inventoried Acres	Reason for Change
6198	Mt. Jefferson	2,700	2,608	Reflects areas which have been roaded since 1979.
6191	Metolius Breaks	10,900	10,907	Adjustments made as a result of some roads and acquiring private land that was unroaded.
6103	Mt. Washington	7,300	0	Was included in the Mt. Washington Wilderness in 1984 with only small slivers of unroaded lands left.
6192	Three Sisters	36,800	8,315	Majority was included in the Three Sisters Wilderness in 1984. A long narrow strip of unroaded land remains.
6195	West-South Bachelor	32,500	30,945	Reduction due to developments at Mt. Bachelor Ski Area and excluding some roads.
6193	Bearwallows	8,100	7,337	Reduced to exclude some roads and an electronic site at Bearwallow Butte.
6194	Bend Watershed	16,200	14,250	Reduced as a result of roads constructed during the Bridge Creek fire and past fire salvage logging and rehabilitation.
6106	Waldo	9,700	4,992	Reduced as much of the area was included in the Three Sisters Wilderness in 1984.
6107	Charlton	9,280	7,243	Reduced because of some new road construction and logging.
6196	North Paulina	22,450	21,622	Reduced because of some new roads
6197	South Paulina	10,200	9,915	Reduced to exclude some roads and power lines
6108	Maiden Peak	29,420	27,800	Reduced because of new roads and timber sales
6111	Odell	14,500	0	Included in Wilderness in 1984.
6109	Cowhorn	22,450	0	Included in Oregon Cascade Recreation Area in 1984.
6132	Windigo-Thielsen	22,300	0	Included in Wilderness and Oregon Cascade Recreation Area in 1984.
	Total	**254,450**	**145,142**	

this trend will stop. On the other hand, the production of lumber and wood products appears to be leveling off, and at times, showing some weakness.

Cultural Resources

Cultural resources are archaeological, historic, and architectural sites and the information they contain about the lifestyles and culture of this Region's prehistoric and historic inhabitants. Cultural resources are of special concern to natural and social scientists, historians, and the public interested in prehistory and history. The Forest's

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[4] Tourism and Recreation in Deschutes County, a draft paper by Jesse N. Butler, Economic Development Planning, Central Oregon Intergovernmental Council, 1135 West Highland, Redmond, Oregon, August 27, 1984.

cultural resource program is integrated into multiple resource planning and management. Its primary goals are: (1) to inventory cultural sites so that their values can be fully considered in Forest planning, and (2) to document and manage these sites and inventories to the extent that they provide a data base useful for scientific and historical research and public appreciation and enjoyment.

The Forest implements and coordinates the laws and regulations pertaining to historic preservation through the State Office of Historic Preservation (SHPO) and Federal Advisory Council on Historic Preservation (ACHP). Cultural sites which qualify for the National Register of Historic Places are managed through consultation with these State and Federal agencies. Recognized American Indian tribes are also consulted regarding Forest Service activities that potentially affect sacred and sensitive sites and areas on the Forest.

Approximately 400,000 acres of the Deschutes National Forest have been inventoried for cultural sites, usually in advance of proposed timber harvesting projects. About 70 percent of the Forest (excluding Wilderness) remains to be inventoried over the next decade, though resurveying and monitoring also occurs in sensitive areas.

Over 600 prehistoric and historic sites have been identified on the Forest. The prehistoric Indian sites are predominantly open-air campsites identified by obsidian flakes and tools. Caves and rockshelter habitation sites are also common but most have been seriously vandalized by artifact collectors. Rock art sites are uncommon. Other prehistoric sites such as rock alignments and tools caches are rare while pithouses and large village sites are nonexistent or have yet to be found. The majority of the prehistoric sites on the Forest are eligible for listing on the National Register of Historic Places because of their potential to yield valuable scientific information about prehistoric culture, technology, and environment.

Several areas of the Deschutes are of religious and cultural importance to the confederated Indian tribes who now occupy the Warm Springs Reservation north of the Forest. Two areas are Black Butte and Green Ridge. Additional information is available from the Warm Springs Tribe's Cultural and Religious Heritage Committee.

Historical sites include the traces of early white immigrant trails and military wagon roads, trapper's and homesteader's cabins, the remains of early railroad logging camps and structures, and Civilian Conservation Corp and Depression-era Forest Service administrative and recreation buildings. The majority of historic sites are related to early (1900-1940) railroad logging in the area. Some of the Depression-era Forest Service administrative sites and CCC structures are listed on the National Register of Historic Places.

The four Ranger Districts composing the Deschutes National Forest all contain a representative sample of the cultural resources described above but their distribution is unequal due to the Forest's environmental diversity. Located along the foothills of the Cascade Mountains, the Bend, Crescent, and Sisters Ranger Districts contain fewer prehistoric sites than the Fort Rock District where sites are abundant due to the availability of obsidian and the District's central position between the Deschutes River and Fort Rock valleys. Historic CCC and Depression-era recreation and administrative sites are evenly distributed across all Districts but the Fort Rock and Bend Districts contain the bulk of the historic railroad logging sites.

Fish and Wildlife

The Forest has a wide diversity of vertebrate wildlife species, including 16 species of reptiles, 8 species of amphibians, 15 species of fish, 84 species of mammals, and 243 species of birds.

The Forest provides fish habitat which supports populations of rainbow, brook, brown, lake, cutthroat, and Dolly Varden trout; whitefish; and some non-native salmon. A further breakdown of the fish and wildlife resources follows.

Species Commonly Hunted and Fished

Mule Deer. There are about 250,000 acres of transition and winter range on the Forest. Of these, approximately 200,000 acres are mature and decadent shrubs. The winter deer population is estimated at 20,300. The average number of deer hunters has been 29,735 on the Forest with an average annual number of deer harvested of 7450. This provides about 157,600 hunter days of recreation annually. (Source is Oregon Dept. of Fish and Wildlife)

Elk. Small herds of elk are scattered throughout the Forest. Few winter on the Deschutes as most cross to the west side of the Cascades. The population is increasing and is currently estimated at 500 to 700 animals.

Waterfowl. Nesting habitat is primarily associated with the larger lakes and reservoirs. Numerous artificial nesting structures have been installed. The current nesting population is estimated at 2,650 pairs.

Resident Fisheries. Inventory data on habitat conditions is limited. However, habitat conditions are considered to be good. Fishing is an important recreational activity on the Forest. Much of the fishing is associated with the larger lakes and reservoirs and the Deschutes River. The Oregon Department of Fish and Wildlife estimate 348,100 angler days of recreation activity associated with fishing. These fishermen spend approximately $7,625,700 in order to pursue fishing on the Forest. Approximately 322,700 fish are caught annually.

Fish species are distributed within the 247 miles of fishbearing streams as shown in Table III-19.

Table III-19 Miles of Fishbearing Streams

Species	Percent of Total Miles
Rainbow	70
Brown	62
Brook	55
Whitefish	46
Kokanee	18
Dolly Varden	17
Coho	3

The above percentages may not represent the actual populations but do indicate the amount of existing habitat.

Lake fisheries may be stratified by grouping lakes into those which are accessible by car and those which are backcountry, walk-in lakes. Table III-20 gives the percent of the number of lakes in each group which support the various fish species.

Table III-20 Location of Fishbearing Lakes (in percent)

	Car Accessible Lakes	Backcountry Lakes
Atlantic salmon	9	-
Brook trout	59	70
Brown trout	19	-
Coho	9	-
Cutthroat	13	7
Dolly varden	6	-
Golden trout	-	4
Kokanee	28	-
Lake trout	13	-
Rainbow trout	72	19
Whitefish	25	-

Threatened, Endangered, and Sensitive Species

Bald Eagle. Bald eagles are listed as a threatened species by the Department of Interior. There are 27 bald eagle nesting territories on the Forest. Fifteen to 20 of this number have been active during past years. Nesting habitat is associated with old-growth ponderosa pine and mixed conifer. Suitable nesting habitat which is not currently being used is also available.

Northern Spotted Owl. The northern spotted owl is listed as a sensitive species by the Forest Service. The Forest has limited habitat for spotted owls. Suitable habitat, which is isolated and found on the northern and southern ends of the Forest, is associated with the mixed conifer timber type. Eleven pairs of owls have been located--three in the Wilderness areas and eight outside the Wilderness.

Peregrine Falcon. The peregrine falcon is listed as an endangered species by the Department of Interior. Records indicate that in the past there have been active eyries on the Forest. Recently there have been sightings of peregrines but no active eyries have been located.

Wolverine. The wolverine is considered as a threatened species by the Oregon Department of Fish and Wildlife. Little is known about its current status. The last confirmed sightings were in 1969 and 1971.

Species With Special Habitat Needs

Osprey. The osprey population has been increasing and is currently estimated at 125 nesting pairs. A large proportion of nesting is associated with Crane Prairie Reservoir. Nesting sites both within the reservoir and adjacent to it are being lost through natural causes. Trees within the reservoir are falling and the mountain pine beetle is killing many trees along the shoreline.

Goshawk. Goshawk habitat is primarily associated with mature lodgepole, ponderosa, and mixed conifer timber types. Some nesting is occurring, however, in ponderosa pine and in younger age classes. Much of the lodgepole habitat is being altered by the mountain pine beetle.

Great Blue Heron. Several rookeries are present on the Forest. They are associated with groups of large ponderosa pine trees and contain approximately 100 nests. Additional potential nest sites are available.

Woodpeckers. Numerous species of woodpeckers and other wildlife are associated with snags. Snag levels in ponderosa pine are deficient at present. In mixed conifer and mountain hemlock snag levels are adequate. In the lodgepole community, there is an over abundance of snags in areas which have not been harvested.

Pine Marten. Pine marten inhabit the mature and old-growth lodgepole pine, mixed conifer, and mountain hemlock stands along the Cascade Crest

Other Species

There are numerous other wildlife species on the Forest. Table III-21 presents a general description of habitat for all species based on existing plant and animal community diversity.

Pronghorn antelope are found in small numbers along the southeastern edge of the Forest. Black bear and mountain lion are few in number and widely scattered, mostly at middle to high elevations. Columbian blacktail deer inhabit the higher elevations along the Cascade Crest during the summer and most winter on the west side of the Cascades. The larger lakes and reservoirs provide suitable habitat for 30 species of waterfowl. There are 17 species of small game, such as mountain and valley quail and blue and ruffed grouse, and 202 species of nongame birds. These include 11 species of owls and 17 raptors (hawks, eagles, falcons).

Future Use of Wildlife

Currently the Forest is capable of supplying more mule deer than are present today. There are indications that the publics demand for deer and fish is expected to grow in the future. There is no data available to determine demand for other species.

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Table III-21 Habitat Based On Plant and Animal Community Diversity

Habitat Characteristic	% of Forest by Habitat Characteristic	Number of Wildlife Species	Number of Vulnerable Species
Coniferous Forest			
Stage I (Grass-forb)	8	55	0
Stage II (Shrub)	8	88	1
Stage III (Saplings)	11	68	0
Stage IV (Immature)	8	82	0
Stage V (Mature)	18	109	8
Stage VI (Old Growth)	31	94	8
Juniper	1[1]	71	0
Meadows	1[1]	65	3
Brush Dominated	2	74	2
Riparian	1[1]	128	17
Alpine	9	21	1
Rock and Talus	3	17	1

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[1] Less than 1 percent.

Energy

Geothermal Energy Resources

What Is It?

It should be noted that the following discussion on the geothermal resource is relatively comprehensive and often does not focus just on the Deschutes National Forest and its potential. The reason for this is that geothermal is a relatively new resource and not as well understood as many of the other resources such as timber, recreation, and wildlife. This discussion is lengthy to help people better understand the resource, not because it is any more or less important than any other resource.

In certain areas of the world, heat from the earth's interior can be found close enough to the surface to be extracted economically. Drill holes that tap hot, valuable fluids are usually less than 10,000 feet deep. A major global zone of geothermal potential is found in a ring of volcanoes surrounding the Pacific Ocean — the "Ring of Fire." The area of Deschutes National Forest is part of this great ring and geothermal indications abound. In parts of central Oregon, geologically young volcanism and hot springs suggest sources of heat; faults suggest corridors along which hot fluids may rise; and steam has been found in Newberry Crater at a depth of only 1200 feet. Newberry Crater, designated a Known Geothermal Resource Area (KGRA), and other areas on Deschutes National Forest are thought to be among the best prospects for geothermal exploration in the continental United States.

Geothermal energy is used directly to heat buildings and green houses, dry lumber, and pasteurize milk. It is also used to produce electricity. The largest development in the world, located at The Geysers about 70 miles north of San Francisco, produces roughly the same amount of electricity as the Trojan Nuclear Plant or Bonneville Dam (both near Portland, Oregon). Each produces about 1,100 megawatts or enough electricity to supply the electric needs of a city of 1 million people. If all geothermal potential on the Deschutes National Forest were developed outside of wilderness areas, the electric output would possibly equal anywhere from ½ to 10 Bonneville Dams (500 to 10,000 megawatts).

Geothermal energy appears to be economically competitive with coal, nuclear energy, and possibly hydropower for the production of electricity. It also appears to offer fewer environmental problems than do coal, nuclear energy, and possibly hydropower.

A geothermal development for the production of electricity usually consists of a power plant supplied with steam or hot water from several nearby wells. Power plants typically produce from 10 to 135 megawatts of electricity with each well contributing 2 to 8 megawatts. Roads, well pads, pipelines, a cooling tower, and a transmission line are also essential. A 50 megawatt power plant and cooling tower may require about 3 to 5 acres. Each well pad may take ½ to 4 acres. Pipelines, generally placed above ground for ease of maintenance, may require the width of a primitive road. Altogether, a 50 megawatt development may affect 20 to 50 acres of land.

Direct Uses of Geothermal Energy

Hot water and steam from wells and springs are used directly in a remarkable variety of ways in the world today -- including heating buildings, heating greenhouses, and raising alligators. World use of non-electric (direct) geothermal energy in 1984 was about 7100 megawatts while electric use was 4600 megawatts. Direct use of hot water is limited by temperature, distance to point of use, and water chemistry. The heat from warm water (10 degrees Fahrenheit (F) or more above average annual air temperature) may be economically extracted with heat pumps especially for heating homes and buildings. With higher temperatures, a greater number of agricultural and industrial processes can be supported. Pasturizing milk, for example, requires a temperature of at lest 140 degrees F, and lumber drying requires about 200 degrees F or more.

Distance between the source of hot water and point of use can be tens of miles if large quantities are needed. Cities in Iceland are heated by hot water carried in insulated pipelines as far away as 60 miles. The chemistry of some hot water may cause unacceptable corrosion or scaling in pipes and equipment. In such instances, methods other than direct circulation must be used such as heat exchangers designed to withstand chemical attack. The chemistry may be such that the only safe method of disposal of the waste water is injection back into the ground through a separate well.

Direct use of geothermal hot water on the Deschutes National Forest has been limited to Newberry Crater. No natural warm or hot water is known outside of the Crater. Water from hot springs (175 degrees F) along the southeast shore of East Lake provided hot baths in a primitive resort from about 1912 to 1930. Today, a hand-pumped water well in Little Crater Campground provides visitors with 95 degree F water. Low volume direct use of hot water, if developed, will most likely be confined to Newberry Crater.

Other direct use may develop from deep exploration and test wells drilled elsewhere on the Forest. Such wells may be drilled with the intention of discovering high temperature fluids suitable for generating electricity. Hot water could be pumped from these wells through pipelines to points of use. Chemically acceptable hot waste water from electric generating facilities could be carried in pipelines to population centers.

Types of Electric Power Plants

Power plants convert heat energy into electrical energy. The temperature and chemistry of geothermal fluids primarily determine which of three basic systems should be used to accomplish this.

Dry Steam

The most desirable is dry steam which contains no liquid water. Steam is brought to the surface in wells and piped directly to steam turbines which drive generators. Liquid water is produced from condensed steam and may be used for makeup in the cooling water system. Excess water is injected back into the reservoir to assist in maintaining fluid and pressure levels. Geothermal power plants at The Geysers, California, and Larderello, Italy, use this system. The probability of discovering new dry steam fields in the Cascades and elsewhere is thought to be less than 10 percent.

Flashed Steam

In this system, hot water is brought to the surface and piped to expansion chambers. Here, 20 to 40 percent of the water flashes to steam. The steam is piped to turbines as in the dry steam system and the remaining hot water is injected into the ground or allowed to run out on the surface. Plants at Cerro Prieto, Mexico, and Wairakei, New Zealand, utilize this system. Most systems are of this type and can be expected on the Deschutes National Forest.

Binary System

In the binary system, hot water passes through a heat exchanger and is immediately injected back into the ground. The heat exchanger vaporizes a liquid with a low boiling point such as isobutane. The isobutane vapor thus formed is used to run the turbines. This is the cleanest method since it is a closed system. This system is used when the geothermal fluid is not hot enough for the flash system or when the hot water is very saline.

Phases of Geothermal Energy Development for Electricity

Exploration

Targeted geothermal areas are explored to locate and define the extent of reservoirs of steam or hot water and to determine the economic feasibility of development. In the Cascades most targeted areas exhibit no direct surface expressions such as hot springs.

Exploration may include aerial and surface surveys. Airplanes are used to make (1) magnetic, (2) photographic, and (3) visual geologic surveys and to sense changes in surface temperatures.

Exploration using existing roads and trails and requiring little land disturbance are "casual activities." Among these are:

- Reconnaissance of surface features and natural phenomena without land disturbance;
- Geologic mapping;
- Geophysical surveys of resistivity, microseismicity, ground noise, magnetism, and gravity; and
- Geochemical surveys of air, water, vegetation, and soil.

"Intense activities", or those requiring minor land disturbance, include shallow and intermediate well drilling. Equipment often consists of a truck-mounted core drilling rig with tanks for water and drilling mud. Road construction and clearing are seldom necessary. Several temperature gradient holes have already been drilled in clearings along existing roads and on old logging landings. Sites drilled on Deschutes National Forest have shown the need to drill deeper than 2000 feet in order to reach below a deep and extensive body of cold ground water.

Test Drilling

During exploration test wells drilled provide subsurface geologic data, locate productive zones within a geothermal reservoir, help delineate the reservoir limits, and provide a means for determining the physical and chemical properties of the reservoir and its fluids.

Equipment used in deep test drilling generally consists cf a conventional oilwell drill rig with a conventional superstructure (tower). Drilling areas (pads) generally require clearing and leveling of 1 to 4 acres, depending on the terrain and number of wells to be drilled from each pad. Drilling rigs, mud pumps, mud tanks, generators, drillpipe stock piles, tool sheds, etc., are usually all on the drill pad. Water and fuel storage tanks may either be on the pad or at another nearby site. A sump, 6 to 15 feet deep, covering a surface area of approximately 1000 to 20,000 square feet, is often excavated to contain geothermal fluids from test flows. A reserve pit that holds drilling muds for recycling is usually located within the sump.

Most existing roads in the area are designed to accommodate logging trucks with a gross weight of 76,000 pounds. These roads are generally adequate to support heavy trucks and equipment necessary for well drilling. Roads into test drilling sites are not intended to be permanent. They may be surfaced with aggregate depending on soil and weather conditions.

Production Testing

Production testing of promising wells is conducted over a period of time to clean them, determine flow rates, and determine other physical and hydrodynamic properties of the reservoir. Venting is done through mufflers so that noise does not rise above ambient levels at a distance of about ½ mile away. Production testing with accompanying noise and discharge of steam varies in duration according to reservoir characteristics but may range from 1 to 3 days for a dry steam system to 1 to 3 months for a hot water system. Reservoirs of hot water are more probable than steam in the Cascades.

Field Development

Favorable results in test drilling and production testing programs generally lead to drilling of additional wells to develop a field. Field development requires improvement of access roads to standards suitable for full time use. Living quarters, along with necessary water and sewage facilities, must be added during this phase, or must be available within commuting distance.

Development of a large geothermal field involves clearing and grading for access roads, well drilling pads, and pipelines. Well pads range in size from 1 to 4 acres, depending on the number of wells to be drilled at each site. The number of wells depends on the characteristics of the geothermal reservoir and individual wells. Pipeline clearings need only be wide enough to accommodate equipment needed for their construction and for fire safety. It is not necessary to clear corridors wide enough to prevent trees from falling across the pipeline.

Throughout the life of a geothermal field, wells must be improved and maintained and new wells must be drilled to keep an adequate supply of steam or hot water flowing.

Information is obtained on the rate and path of recharge and natural discharge of the geothermal reservoir, estimate of reserves, optimum rates of production, and resource conservation considerations.

Powerplant, Pipeline, and Powerline Construction

Construction of facilities for generation and transmission of power follows a thorough examination of all environmental impacts, including an analysis of all available information on the geothermal reservoir and fluids.

Power generation and transmission facilities are constructed in stages consistent with the capacity of the geothermal reservoir.

Power plants at The Geysers geothermal field range in size from 10 to 135 megawatts. Typical sizes constructed in the past few years are 55, 80 and 110 megawatt power plants. A 55 megawatt plant is housed in a building 140 feet long, 34 feet wide, and 30 feet high. The cooling tower consists of 3 units each measuring 36 feet by 66 feet and placed side by side. This plant requires a 7 acre area. A 135 megawatt plant consists of a turbine building 173 feet long, 83 feet wide, and 66 feet high. The cooling towers occupy an area 360 feet long by 75 feet wide by 65 feet high.

Above ground, insulated pipes with U-shaped expansion loops are used to pipe steam or hot water from wells to power plants. Underground pipelines are possible but impractical because of pipe expansion and high consruction and maintenance costs. Construction costs would increase about 25 percent to place pipes underground.

Full Scale Production

During the full scale production, activities consist primarily of maintenance of power plants, related facilities, and the drilling, redrilling, and workover of geothermal wells to maintain production.

Construction activity during the production phase is reduced to a level that allows much of the land in lease areas to be used for other uses.

Life of a Geothermal Field

The useful life of fully developed geothermal fields is believed to be 25 to 100 years. The Larderello field in Italy has been in operation since 1913, a period of about 70 years. This field, however, is not fully developed. Much remains to be learned about the life of geothermal fields.

Restoration

Site restoration is a part of the geothermal operation that begins with the completion of the first well and continues through the life of the field. Wells, power plants, and other installations are removed as the geothermal resource is exhausted. Thus, restoration may be underway in one part of the field while development is in progress in another. Complete restoration includes removal of all installations such as pipelines, buildings, generators, and power transmission towers and lines. Wells are sealed, and roads, well pads, and other clearings are regraded and revegetated.

Present Knowledge of Geothermal Potential

A geothermal resource may exist if vertical channels in the ground allow large amounts of rain or melted snow to travel deeply to a heat source of hot or molten rock. The heated water or steam rises along other vertical channels to a large holding area or reservoir which, if penetrated by drilling, yields hot water or steam. If this system leaks to the surface, it can produce hot springs, fumeroles, mudpots, and geysers. Such is the case at Yellowstone National Park. Once heated, the water becomes gas-charged and mineralized to widely varying degrees.

All conditions mentioned above are thought to exist in several areas on the Deschutes National Forest. Volcanic events occur here on a time scale of hundreds to thousands of years which suggest that hot or molten rocks lie within 5 miles of the surface in these areas. Vertical fractures along which water can travel are clearly evident at the surface in a few areas but generally are obscured by young lava flows. Water is abundant. The young volcanic rocks are highly fractured and permeable so that leaks from geothermal reservoirs spread out under the ground instead of rising to the surface to make hot springs. The only exception is hot springs and warm ground water in Newberry Crater.

Choosing exploration targets is difficult because geothermal reservoirs thought to exist have no surface expression; that is, no hot springs, no tell-tale mounds of minerals from fossil hot springs, and no gas vents. Areas of young and voluminous volcanic activity are of greatest interest. Here, gravity, magnetism, seismicity, and electrical resistivity measured from the surface or air may reveal signatures of rock type, hot rock, vertical channels, and mineralized water. Drill holes in these areas must penetrate deeply enough to show elevated temperatures and rock types.

Several geologic and geophysical surveys have been made recently by public agencies and private companies. A few holes have been drilled up to 3000 feet deep. Holes to 4000 feet are planned. Except for holes drilled by public agencies in Newberry Crater, all other significant holes have been drilled by private companies. Information from private companies is generally not available. So far, the only clear evidence of high geothermal potential is from drill holes in Newberry Crater. A hole drilled to 3058 feet by the U. S. Geological Survey in 1981 revealed a temperature at the bottom of 509 degrees F (265 degrees C) and yielded steam at the surface during a 20-hour flow test.

All public information related to geothermal potential on Deschutes National Forest is either inconclusive or encouraging. Exploration is in its infancy and will move forward only after substantial intermediate to deep drilling is completed.

Areas of Geothermal Potential

Current available information shows that four areas tend to stand out as having high geothermal potential. All of these areas exhibit considerable amounts of geologically young volcanic rocks. The rest of Deschutes National Forest appears to have at least a moderate potential for geothermal resources.

Newberry Volcano

Newberry Volcano is a large, broad composite volcano that covers about 500 square miles. Most of its great bulk consists of ash, pumice, and tuff--all products of explosive eruptions. Most volcanic material erupted from Newberry Crater, a caldera. Lava and cinders have erupted from fissures on the north and south flanks burying great expanses of ash, pumice and tuff. The entire volcano is probably younger than 700,000 years old. The most recent eruption occurred within the caldera 1400 years ago. Areas closest to the caldera probably have higher geothermal potential than those lower on the volcano.

Bearwallow Butte/Melvin Butte Area

This area is part of a prominent highland that extends eastward from the Three Sisters. Rocks from this highland indicate a favorable environment for geothermal reservoirs. These rocks (andesite, dacite, and rhyolite) are thought to lie in large, hot or molten mass within 5 miles of the surface. If they were to rise to the surface, they could erupt explosively and/or build volcanic domes much like recent eruptions have done at Mount Saint Helens. Bearwallow Butte and Melvin Butte are domes similar to the one in the crater of Mount Saint Helens. Several sheets of pumice, ash, and tuff in the Bend to Sisters area erupted violently from this highland. Most or all of these eruptions occurred less than 1 million years ago.

Mount Bachelor/Dry Butte Area

About 12 cubic miles of lava and cinders erupted 15,000 or so years ago to form a 16-mile-long chain of volcanoes from Mount Bachelor to Dry Butte (near Lookout Mountain). The geologic youth of this volcanic chain suggests the presence of geothermal reservoirs.

Sparks Lake/South Sister Area

In this area obsidian domes and lava were erupted about 2000 years ago, and cinders and lava erupted under a glacier about 15,000 years ago to form Katsuk Butte. These and other events suggest sources of heat for geothermal reservoirs.

Estimate of Geothermal Potential on Deschutes National Forest

With the exception of Wildernesses, geothermal electric potential is estimated to be 500 to 10,000 megawatts sustainable for at least 30 years. This estimate is based on previous estimates[5,6,7,8,9], and local knowledge[10].

Estimates of potential for all areas in the Oregon Cascades range from 2500 to 402,000 megawatts[5]. Most workers believe that the central Cascades of Oregon have proportionally higher potential than other areas in the Cascades.

Estimates of geothermal potential at Newberry Crater range from a few to 13,000 megawatts[6,7,8,9]. A study by the Bonneville Power Administration uses an estimate of 1600 megawatts[9]. Estimates at other areas thought to be favorable have not been made.

All indications to date suggest modest to large geothermal resources on Deschutes National Forest. However, lacking information from drill holes and geothermal reservoirs, estimates of potential will continue to range widely.

Economics of Geothermal Development and Operation

Introduction

The demand for electricity in the Pacific Northwest and nearby states is difficult to accurately forecast. So also is geothermal potential in the Pacific Northwest. However, a draft geothermal assessment by the Bonneville Power Administration concludes that geothermal potential in central Oregon appears high and that geothermal development appears feasible at the present time.

The size of a geothermal power plant is largely determined by how productive and how closely spaced wells will be. Generally, if the distance to production wells is less than a mile, constructing one large power plant makes better economic sense than constructing several small ones that are close to each other. To give an idea of investment levels needed to construct power plants, total cost to bring a 10 megawatt power plant on line by 1990 would be about $42,000,000; for a 50 megawatt, $162,000,000 (draft BPA-Regional Geothermal Assessment).

Rent, Royalties, and Value of Electricity

Before electricity is produced from a geothermal lease on federal land, the lease holder must pay rent of $1 to $3 per acre per year depending on the type and duration of the lease. When electricity is produced and sold, a royalty of 10 to 15 percent is charged for geothermal plants operated on leased federal land. On Deschutes National Forest the royalty rate is currently 10 percent. In Oregon the royalty is divided equally between the federal government and the county in which the geothermal lease is located. Currently at The Geysers in California where the royalty is 12.5 percent, a 50 megawatt power plant produces a royalty of about $1,800,000 per year. The price paid by a utility to a steam supplier at The Geysers is about $0.039 per kilowatt-hour.) On Deschutes National Forest, a 50 megawatt power plant should also produce a royalty of about $1,800,000 per year.[11]

A utility would probably pay $0.05-0.06 per kilowatt-hour for the electricity.

Construction, Operation, and Maintenance[12]

The most labor intensive part of developing a geothermal resource is construction of the power plant, pipelines, and well drilling. Based on experience at The Geysers, construction of a 50 megawatt power plant requires an average of about 50 workers per day for about 24 months. At times the number may reach 120 per day. Since a variety of technical, skilled and unskilled workers are needed, the cumulative work force during this time will be about 600 (that is, the total number of people who work, even for a short time, at the construction site). Local contractors and workers would most likely play an important role in construction of such a geothermal power plant.

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[5] Black, Gerald L., David D. Blackwell, and John L. Steele, 1983, Heat Flow in the Oregon Cascades in Geology and Geothermal Resources of the Central Oregon Cascade Range: Oregon Dept. of Geology and Mineral Industries, Special Paper 15, p. 69-76.

[6] Muffler, L. J. P. (ed.), 1979, Assessment of Geothermal Resources of the United States—1978: U. S. Geological Survey Circular
790, 163 p.

[7] Black, Gerald L., 1982, An Estimate of the Geothermal Potential of Newberry Volcano, Oregon: Oregon Geology, vol. 44, no. 4, p. 44-46.

[8] Black, Gerald L., 1982, A Revision to the estimate of the Geothermal Potential of Newberry Volcano: Oregon Geology, vol. 44, no. 5, p. 57.

[9] BPA-Regional Geothermal Assessment (draft), 1985.

[10] Chitwood, L. A., 1985, U.S.F.S. written communication.

[11] Wassinger, Charles. Geologist. Bureau of Land Management. Ukiah, California. March 19, 1985. Personal communication to discuss economics of geothermal power plants.

[12] Fujimoto, Robert W. Geologist. Bureau of Land Management. Portland, Oregon. March 1985. Personal communication to discuss economics of geothermal electricity development.

The operation and maintenance of a 50 megawatt power plant requires only about 11 to 18 skilled and technical people. Operations require 6 to 8 people and maintenance requires a crew of 5 to 10. At times, drill crews and equipment must be brought in to drill new wells to replace old depleted ones.

Summary of the Management Situation

The Intent of Leasing

The Geothermal Steam Act of 1970 authorized the Secretary of Interior to dispose of geothermal steam and associated resources on most Federal lands. There are exceptions for certain areas such as National Parks, Wildlife Refuges, and National Recreation areas. The Act provides for a system of leasing (similar to that for Gas and Oil and other leasable minerals under the Mineral Lands Leasing Act of 1920) which permits development and utilization of geothermal resources. The legislation includes prescribing regulations needed to implement the Act. It also provides that National Forest lands be leased only with the consent of, and under such conditions as are prescribed by, the Department of Agriculture.

When the Government issues a lease it confers some of its ownership rights to the leasee. The basic rights conferred are the rights to explore for and to develop the geothermal resource if discovered. The government retains other rights which would not interfere with the rights granted. The Federal controls over leasing are contained in the Geothermal Steam Act and other laws such as the National Environmental Policy Act, the Federal Clean Air Act, and the Federal Water Pollution Control Act. Other controls are in Federal Regulations, Geothermal Resource Operational Orders, the geothermal lease, and lease stipulations developed to cover special situations not covered by the other controls. (See Appendix G.)

Status of Leasing and the Decisions Made to Date

The Forest began receiving geothermal lease applications in 1974. Initial applications were for the area at Newberry Crater. These applications were no doubt prompted by the geologically young volcanic rocks of Newberry Volcano and hot springs along the shores of East and Paulina Lakes in Newberry Crater. Newberry Caldera and some surrounding area were designated the Newberry Crater Known Geothermal Resource Area (KGRA) in 1976 by the U.S. Geological Survey. KGRA's are designated areas considered to have high potential for geothermal resources. The criteria for establishing KGRA's can be found in Appendix G. From 1974 to the first part of 1985, interest in the Forest's geothermal resource potential continued so that a total of 463 lease applications have now been filed.

In order to respond to these applications, separate Environmental Assessments were completed for the Fort Rock and the Sisters Ranger Districts in 1982 while the Bend and Crescent Ranger Districts were combined into a third Assessment completed in 1984. Following the decisions from these Environmental Assessments, some 177 leases have been issued by the Bureau of Land Management as of early 1985. Table III-22 shows the status of geothermal leasing on the Forest.

Table III-22 Status of Geothermal Leasing

STATUS[1]	NUMBER	ACREAGE
Pending Applications	116	206,000[2]
Leases Issued	177	354,700
Applications Rejected or Withdrawn	170	
Total	463	

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[1] As of the First Quarter of CY 1985

[2] This acreage includes the acreage of overlapping applications.

Treatment of Wilderness and the Oregon Cascades Recreation Area

The previous Environmental Assessments for geothermal leasing have not considered or made any decision about leasing for the Newberry Crater KGRA (31,000 acres), the Oregon Cascades Recreation Area (42,600 acres) and several small tracts which lie outside but adjacent to Wilderness (9,600 acres). The latter area resulted from differences between the previous Environmental Assessment boundaries and the boundaries of the Oregon Wilderness Act. Since by law leasing is not permitted in Wilderness areas, neither the previous assessments nor this one have considered the geothermal resource in Wilderness areas. The Oregon Cascades Recreation Area prohibits leasing after 1989. In keeping with this, there is no leasing planned for the Recreation area.

Decisions the Land Management Plan Will Make

Geothermal direction in the Plan will apply to the above described areas (except Wilderness) which are receiving environmental analysis for the first time and to applications pending and new applications received after the effective date of the Land Management Plan. Also the Plan direction will apply to areas where applications have been withdrawn or where leases have been terminated. The decision about leasing and lease conditions will be determined through a second level Environmental Assessment tiered to, and reflecting, the Plan direction.

Decisions Previously Made and Their Relation to the Forest Plan

Existing leases and those issued before the Plan becomes effective are controlled by the decisions of the three geothermal assessments mentioned above. These leases generally will not be affected by the Forest Plan direction because they cannot be modified without the consent of the leasees. The remaining area of the Forest is where the direction of the Plan will be applied.

Classification System

In order to understand the geothermal resource potential, there is a need to have a resource inventory. From an inventory standpoint mineral resources cannot be identified with the same degree of certainty as many surface resources; therefore, a broad classification system was utilized to rate the geological potential or likelihood of occurrence of the geothermal resource. The classification system uses four classes and rates the resource potential as high, medium, low, and unknown. Table III-23 shows the amount of acres for the various resource potential classes in areas that have been leased to date and the area of the Forest that remain unleased.

Oil and Gas

A few applications have also been received for oil and gas leases. The Forest currently has one Gas and Oil lease. According to U.S. Geological Survey maps, most oil and gas potential lies east of the Forest on neighboring Bureau of Land Management and Ochoco National Forest lands. Both of these land managing agencies have received applications over the past few years and have issued a large number of leases.

Hydropower

Currently there are no commercial hydropower facilities on the Deschutes National Forest. The North Pacific Division of the Corps of Enginers released a report entitled "Summary of Northwest

Table III-23 Geothermal Resource Potential Classification in Acres

Area	Resource Potential				
Status	Low	Medium	High	Unknown	Total
Leased	13,100	269,800	71,800	0	354,700
Unleased	410,000	654,800	200,900	0	1,265,700
Unleased, excluding Wilderness & OCRA	410,000	504,500	126,100	0	1,040,600
Total: Including Wilderness	423,100	924,600	272,700	0	1,620,400
Excluding Wilderness	423,100	774,300	197,900	0	1,395,300

Table III-24 Hydropower Applications on the Deschutes National Forest

	App. No.	Proposed Capacity	Status
Deschutes River @ Pringle Falls[1]	6573-000	---	Water rights denied by State.
Wickiup Dam Retrofit	3560-001	7.0 MW	Applied for license 1982.
Columbia Southern Canal	6473	3.0 MW	Preliminary study permit issued.
Crane Prairie Dam	3446-001, 4171	3.5 MW	Dropped
Lava Diversion (Benham Falls)	5205	16.0 MW	Applied for license 1984
Arnold Irrigation[1]	7306	3.8 MW	Exemption
Squaw Creek	7903	3.5 MW	Preliminary permit issued.

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[1] Amount of the project on the National Forest may be minor.

Hydroelectric Power Potential" in 1976. In this report the Corps discusses its evaluation of the potential of the Deschutes and Metolius Rivers for large-scale power generation and found it to be economically infeasible. However, since 1980, 7 applications for low-head hydropower production on streams flowing through the Deschutes National Forest were filed with the Federal Energy Regulatory Commission. These applications and their status are shown in Table III-24.

Of the pending applications, all but the Lava Diversion and the Squaw Creek project use existing irrigation facilities. The Lava Diversion would require construction of a new facility.

Firewood

A major source of energy on the Forest is fuelwood for home heating.

The fuelwood supply is probably at an all-time high as a result of the mountain pine beetle epidemic in the mature lodgepole pine forests. In 1984 approximately 230,000 acres were infested resulting in an abundance of fuelwood. Fuelwood is also available as a result of the wood residues left from timber harvesting.

Although this resource is removed in small increments, the total volume removed from the Deschutes is substantial. A conservative estimate is that 60,000 cords of personal use firewood and 50,000 cords of commercial firewood were removed from the Deschutes National Forest is 1983. This equates to approximately 37 MMBF, or about 18.4 percent of the annual chargeable timber cut from the Forest. According to these estimates the average permittee removed about 1.5 MBF, equivalent to about four or five cords. Revenues to the Forest from personal use firewood permit sales were approximately $200,000 in 1983.

Growth in firewood use is evident by the fact that the number of firewood permits issued annually over the past 13 years has increased 1,000 percent. Some of this increase in personal use firewood consumption is attributable to an increase in local population. Estimated Deschutes County population has more than doubled from 30,000 in 1970 to 64,000 in 1982. Increasing costs of alternative energy sources has also been a factor. Firewood cutting also appears to be a way of life in Central Oregon, both as a source of supplemental income and as a recreation experience.

The combination of increasing population, rising energy costs and easy availability have made firewood an increasingly important product of the Deschutes. Several factors, however, may temper this rising trend in the future. These include: (1) slow to moderate future population growth, (2) increasing remoteness of good wood sources as areas near towns are cleaned out, (3) the possibility of regulation of wood burning stoves to preserve air quality, (4) the increasing energy efficiency of new homes and leveling off of the increases in alternative energy sources, and (5) the continuing harvesting of lodgepole pine in the Forest's normal sale program.

If firewood consumption levels off, 20 percent of the current mature lodgepole pine inventory will be removed as cords of firewood over the next 10 years. If we assume that firewood consumption increases at 10 percent per year, as much as 40 percent could be removed as firewood in the next 10 years.

Transportation System

There are over 9,700 miles of roads on the Forest of which 7,700 miles are Forest Service roads providing various levels of service. The standards range from the two-lane paved highway to the primitive single-lane dirt road. Each road is constructed and maintained to meet the access requirements for a specific land area. For example, the road to a developed, high-use campground requires a higher level of service than a road to a woodcutting area. Another example may be the closure of roads for the purpose of wildlife protection.

All roads within the Forest are open to the public unless blocked or signed with a road restriction or closure. The Highway Safety Act has established Nationwide standards for the design, operation, and maintenance of all highways, roads, and streets. These same standards apply to forest roads where passenger car use is encouraged. The construction and maintenance costs for roads in this category are several times higher than for roads excluded from the Act.

Currently, about 80 percent of the Forest road system is managed for high clearance vehicles (roads excluded from the Act). It is assumed that the users of these roads are familiar with the hazards normally encountered, such as rocks, fallen trees, minor ditches. However, unusual hazards, e.g., washouts, are corrected or marked.

Table III-25 describes the Forest Road System.

Table III-25 Roads on the Deschutes National Forest

Type of Road	**Miles**
Primary Access	769
Secondary Access	1,062
Local Roads	7,875
Total	**9,706**

Soils

Soils are derived almost entirely from volcanic ejecta, residuum from basalts and andesites, and glacial deposits. The most widespread surface soil material is a light-colored, coarse-textured, dacite pumice from Mount Mazama (Crater Lake). This gravelly, coarse sand is 6 to 10 feet thick on the southern end of the Forest and becomes thinner and finer to the north. Near Bend, it is a pumiceous loamy sand about 2 feet thick. Several other less extensive pumice, cinder, and volcanic ash deposits can be found on the Forest.

The Deschutes National Forest is somewhat unique in that it does not have a major problem with surface erosion and mass failure. This is primarily due to the fact that the terrain is very gentle and that the volcanic soils of the area are very porous. Since the soils in the area are capable of absorbing and transmitting water very rapidly, the potential for surface erosion is very limited. While there are instances of mass failure on the Deschutes National Forest, the frequency of occurrence is very low and does not represent a major threat to water quality.[13]

Water

Streams

The surface water on the Deschutes National Forest is very different than the streams and lakes on most of the National Forests in the United States. Most of the streams on the Deschutes originate in large springs and are, therefore, very stable flowing. A good example of this is the Metolius River which rises from a series of spring vents near Black Butte. The Metolius is one of the largest spring-driven streams in the United States. The result of the spring origin of many of the streams is that the streams are not subject to the wide variability of flows commonly found in streams in the western US. Flooding on the Deschutes National Forest occurs only under extreme circumstances such as when there is rapid snow melt on top of frozen ground. Also associated with the very stable flows is the fact that the stream banks are generally low and in good condition. Riparian vegetation is in good condition throughout the Forest and serves to protect the streambanks from the occasional over-bank flow.

Lakes

Lakes on the Deschutes National Forest are glacial, volcanic, or man-made. Some of the lakes have surface inflow but no surface outflow (Davis, Sparks). Others have no inflow but considerable surface outflow (Little Lava, the source of the Deschutes River). There are a total of 304 lakes on the Forest, many of which are small glacially formed lakes in the Wilderness areas near the Cascade crest. There are three major irrigation reservoirs on the Forest: Wickiup, Crane Prairie, and Crescent Lake. These three reservoirs provide a total storage of about 341,000 acre feet which is used to irrigate lands north and east of Bend and as far north as Madras. Two lakes (Paulina and East) lie within the caldera of Newberry volcano. While there is no surface inflow into these lakes, one stream does flow out of the crater. These lakes represent a unique hydrologic regime on the Deschutes National Forest in that they are isolated and tied to an area of significant geothermal resources.

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[13] Larsen, Daniel M. Soil Resource Inventory, Deschutes National Forest, Pacific Northwest Region, 1976.

Water Quality

The water quality of streams and lakes on the Deschutes National Forest has been monitored for several years by the Forest Service, the Oregon Department of Environmental Quality, and the Oregon Department of Fish and Wildlife. With the exception of temperature there have been very few violations of existing water quality standards. Where large amounts of water are diverted for irrigation, the temperature of the remaining water often exceeds the water quality standard. While there have been documented cases of isolated biological pollution (giardia lamblia), most of the surface water monitored has been very low in bacteria and other water quality variables. The surface water is characteristically very cold (40-42 degrees Fahrenheit) due to the influence of groundwater inflow to or origin of the streams. The surface waters on the Forest are very low in chemical concentrations and the water is suitable for all the identified beneficial uses in the Deschutes River basin.

Water Uses

Surface water on the Forest is a focal point for a lot of the recreational use the Forest experiences. At least 50 percent of the recreation use is tied to water: boating, fishing, hiking, camping. The water produced on the Forest is also used for irrigation, domestic water supply, and power generation. The City of Bend, under a Memorandum of Understanding with the Secretary of Agriculture, diverts water for municipal supply. The City of Sisters and the Mount Bachelor ski area also divert water for drinking water supply. The largest use of water produced on the Forest is irrigation. About 864,000 acre feet of water are diverted annually to irrigate 160,000 acres between Bend and Madras. Runoff from the Forest is used to generate power in Bend, and at Round Butte, Pelton, the Dalles, and Bonneville dams. Many of the streams on the Forest are currently being evaluated for low-head hydopower potential.

The Deschutes River Basin above Bend was withdrawn from further water rights appropriation by the State Engineer in 1969. This withdrawal means that applications for surface water use in the upper basin are not accepted by the State except in certain situations. The Deschutes National Forest currently has several water rights for use of water, and is filing on those uses for which the State will accept applications. Where it is not possible to obtain a surface water right, other sources are being considered (e.g., groundwater, purchase of water). It appears that the greatest potential for increasing water yield on the Forest is through increased transmission efficiency of the irrigation canals and ditches, which currently have 45-50% losses, rather than through vegetative manipulation.

Air Quality

Air quality in Deschutes, Klamath, and Jefferson Counties is considered to be very good. Monitoring sites for measuring air quality variables are few. Population densities and the prevailing climate rarely allow concentrations of particulates or chemicals.

Notable exceptions to the characteristic good air quality do occur, however. Local inversions will retain smoke in populated areas during the winter. Usually though, the inversions will break down by afternoon and allow the smoke to dissipate. Occasionally smoke from agricultural burning near Madras or in the Willamette Valley drift into the area and stay for short periods of time. Dust particles from the pumice soils are commonly seen as an impact to the local air quality. Most of this dust originates from vehicle using unsurfaced roads and winds blowing through unvegetated areas. The Environmental Protection Agency shows in its 1979 Environmental Quality Profile for Oregon that air quality standards have been violated due to "fugitive dust' in Deschutes and Klamath Counties.

Fire

Before 1900 portions of the Forest burned periodically, especially in the more flammable pine species. These fires, occurring at 5- to 25-year intervals at the lower elevations, were often of low intensity and burned accumulations of forest litter and light brush. Many years of effective fire suppression efforts have caused unnatural accumulations of needle litter, dead limbs, and dead trees which can lead to high intensity damaging wildfires. Serious outbreaks of mountain pine beetle infestations are adding additional fuels.

The fire workload has been moderately heavy for a Pacific Northwest Forest. Over the last two decades, 1,986 of the wildfires were lightning caused and 1,550 were man-caused. An average of 978 acres burned each year.

Man-caused fuels are generally the result of untreated slash.

The number of man-caused fires have remained fairly stable in the area for some time. The one major exception is the number of man-caused fires associated with the housing developments in the woodland setting adjacent to National Forest land. This class of fire constitutes a serious threat to life and private property and is our number one concern.

Minerals

The youthful volcanic and glacial landscape of the Deschutes National Forest provides economic materials unique to this area. Volcanic cinders are plentiful. Table III-26 shows estimated volumes and acres of some of the more important minerals on the Forest. Pumice is also a valuable mineral for which there are several claims on the Forest. There is relatively low potential for metallic (locatable) minerals. The Forest appears to have relatively high potential for geothermal and low potential for oil and gas, which are leasable minerals.

Table III-26 Mineral Volumes

Mineral	Cubic Yards	Acres
Cinders	68,695,000	1001
Gravel	7,365,000	287
Hard Rock	1,780,000	125
Clay	2,800,000	86
TOTAL	**80,540,000**	**1,499**

Caves

Ice caves, lava tubes and caverns, and bedrock faults abound throughout the Deschutes National Forest as a result of this Region's recent volcanic activity. A number of well known ice caves and lava tubes, such as Arnold Ice Cave and Lava River Cave, are popular recreation sites on the Forest. Others, however, are found in remote areas of the Forest and their exact locations remain imprecise. Some caves are hazardous, or badly vandalized, to the point that they are now closed to the public.

Caves and lava tubes are a resource having unique educational, scientific, biological, recreational, and scenic values. Some caves contain unique year-round ice speleotherms and snow and ice. Many are home to bats and other wildlife which depend on their shelter and water in an otherwise semi-arid environment. Numerous lava tubes are part of immense underground networks and passages and are popular among cave explorers and recreationists. Finally, most caves contain evidence of prehistoric human habitation and are, therefore, invaluable archaeological resources.

Currently, most caves and lava tubes are preserved in their natural condition. Only a few have been interpreted for the public or have associated recreation facilities. Some have been closed to the public due to recurrent vandalism.

Research Natural Areas

There are two designated Research Natural Areas (RNA's) on the Forest. The Metolius RNA is located within the Sisters Ranger District and contains 1,318 acres. It contains the following plant communities: ponderosa/bitterbrush/fescue, bitterbrush/needlegrass on volcanic ash, manzanita-snowbrush/needlegrass on volcanic ash, ponderosa/snowbrush- chinquapin, and snowberry/pinegrass.

The Pringle Falls RNA is located within the Experimental Forest on the Bend Ranger District and contains 1,357 acres. This RNA contains ponderosa pine/bitterbrush and lodgepole pine/bitterbrush communities.

During 1980 a survey was conducted to review the 11 proposed RNA's designated in the 1978 Forest Management Plan. As a result of the survey, 7 of these areas meet the Regional needs and requirements for RNA's. Table III-27 describes acres and regional need. For more detailed information see Appendix F. The seven potential sites for RNA's are:

Table III-27 Potential Research Natural Area Descriptions

Name	Acres	District	Meets Regional Need For
Little Cache Mtn.	660	Sisters	Lakes at moderate elevation surrounded by mixed conifer forests.
Cultus River	300	Bend	Large, upwelling cold spring.
Katsuk Butte	990	Bend	High elevation, undisturbed entirely forested cinder cone.
Many Lakes	1,075	Bend	Typical bog areas, sub-alpine permanent ponds, alpine lakes and ponds and high elevation lodgepole pine communities.
Torrey-Charlton	500	Bend	Mountain hemlock plant community.
Mokst Butte	890[1]	Ft Rock	Entirely forested cinder cone with white fir and a recent lava flow.
Wechee Butte	425	Ft Rock	Undisturbed entirely forested cinder cone with varying topography.

[1] 500 of these acres lie within the Lava Cast Forest Special Interest Area.

Economic Environment

In order to assess the current economic and social conditions, and to estimate and monitor potential changes that might result from the implementation of a Forest Plan, a "Forest Influence Zone" was delineated. The Forest Influence Zone is the geographic area where the majority of Forest products are first used and where public concern about management of the Forest is concentrated. While forest management decisions on the Deschutes may have economic consequences to people outside of the nearby surrounding communities, the majority of resulting economic impacts are felt within the local economy. Therefore, because of its dominance in the Forest Influence Zone, Deschutes County was often used as a proxy for the full zone of influence for purposes of economic impact analysis. A larger area, which includes communities in adjacent counties and the Willamette Valley, was used for the social analysis.

Population

The 1980 census showed that Deschutes County's population was 62,142, Jefferson County was 11,599, and Klamath County was 59,117. Deschutes County grew by 31,700 people from 1970 to 1980, an increase of 104 percent. This equates to an annual growth rate of about 7.2 percent. Of this net change, only 10 percent (3,162 persons) was due to natural increase. The vast majority of the growth, 90 percent (28,538 persons), was due to in-migration. However, since 1980 the population growth rate has slowed significantly to about 1.5 percent per year.

The only incorporated cities in the Forest Influence Zone are located in Deschutes County: Bend (1980 population 17,263), Redmond (1980 population 6,452), and Sisters (1980 population 696). Concentrations of people in the unincorporated part of Deschutes County include the areas east and south of Bend and the communities of LaPine, Sunriver, Tumalo, and Cloverdale. In 1980, 40 percent of Deschutes County's population lived in incorporated cities, while 60 percent lived outside of these communities.[14]

The Crescent division of Klamath County has no incorporated cities. Communities in this area include Crescent, Gilchrist, and Chemult. The Grandview division of Jefferson County also has no cities. Settlements in this division include Camp Sherman and Grandview.

Obviously, Deschutes County's growth depended on attracting people from elsewhere. People cite recreation opportunities, climate, and quality of the environment as reasons for moving to and living in Deschutes County.

Local Economy

The three most important basic industries in the Forest Influence Zone include agriculture, wood products manufacturing, and recreation and tourism.[15]

Agriculture

While increasing slightly in absolute terms, agriculture within the Forest Influence Zone has been diminishing in relative importance. In Deschutes County, gross cash farm income increased from $11.3 million in 1970 to $13.3 million in 1980, and to $16.1 million in 1983. However, agricultural producers in Deschutes County are facing increasing production costs and decreasing (or constant) farm prices. These factors, coupled with inflation, are resulting in the sale of many farms.

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[14] Labor Market Information, LM, State of Oregon, Employment Division, Department of Human Resources, 1984.

[15] Butler, Jesse N.; Hewell, Denny; Sullivan, Michael C. Overall Economic Development Program for Central Oregon, for FY 1984-1985. Central Oregon Intergovernmental Council, 1984.

Manufacturing

The manufacturing component of the Forest Influence Zone is dominated by the wood products industry. This industry currently employs about 17 percent of all workers in Central Oregon. The remainder is made up of diverse light industries. Wood products manufacturing is directly tied to the national housing market, and the housing market is tied to mortgage interest rates. Current high interest rates, plus increasing competition from Canadian imports are causing some instability in the industry.

Timber Industry

Harvesting

In 1984, nearly 244 MMBF of timber were harvested from the Deschutes National Forest. From 1980 to 1984, the average timber harvest was 186 MMBF.

Mills in Deschutes County are heavily dependent on timber supplied by the Deschutes National Forest. However, this relationship has experienced some unprecedented changes over the last few years. Ten years ago, over 80 percent of the logs bought by Deschutes County mills came from the Deschutes National Forest. Since 1981 this relationship has changed to the point where in 1983 only 47 percent of the timber sold from the Deschutes was purchased within the traditional Forest Influence Zone. Much of the volume began to go west over the Cascade Mountains due to the prospects of timber supply reductions on that side of the mountain range. It is anticipated that for the next five to ten years, local mills will continue to operate in a more competitive market for Deschutes timber.

Primary Processing

Currently two major sawmills are operating in the Forest Influence Zone--one in Bend and one in Gilchrist. In addition, Prineville has one major sawmill and five smaller sawmills. The three major mills have large and small log handling facilities. Together these mills have an estimated installed capacity, on a two-shift level, of about 463 million board feet per year. Of this total capacity, 72 million board feet represent capacity for small logs. Also, a veneer plant which has a capacity of 50 million board feet is located in Redmond.

Secondary Manufacturing

The dominant secondary wood processing activity in the Forest Impact Zone is millwork manufacturing. Ponderosa pine boards are the most common raw material for this industry. Furniture and cabinet making firms also exist in the area.

Recreation and Tourism

The recreation and tourism industry is increasingly being touted as a mainstay of the local economy. Winter and summer recreation expenditures have added an element of stability to the otherwise volatile wood products based economy. In 1983, 1.54 million out-of-State tourists visited Central Oregon, and spent an estimated $187.2 million during their stay. It is also estimated that an equal number of Oregonians visited Central Oregon during that year. In total, the resulting recreation expenditures generated approximately $374.4 million in personal income to the local economy.[16] Most of the recreation activities that attract these visitors are related to the opportunities on the Deschutes National Forest.

Social Environment

People and communities in the Zone of Influence have important, but different, ties to the Deschutes National Forest. The nature of these ties means that aspects of the Alternatives could affect each somewhat differently.

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[16] Butler, Jesse N. "Tourism and Recreation in Deschutes County," Central Oregon Intergovernmental Council, 1984.

Four types of communities have been identified and will be described. Also, two types of ties between Forest and community have been identified. One tie between Forest and community is its contribution of raw material for industry and the jobs it and Forest management provide. A second tie is the scenic and recreational environment the Forest offers to recreationists and residents. Two of the community types have very clear and nonoverlapping ties to the Forest, while the other two communities are affected by both types of ties but in different ways.

Rural Industrial Communities

Rural industrial communities are closely tied to the Forest in work, subsistence, and play. The supply of available timber constitutes the economic link between the Deschutes National Forest and these communities with regards to their timber harvesting, wood processing, and transportation businesses. The wood products industry is the predominant industry in towns like Crescent, Gilchrist, Prineville, and Redmond. But timber is not the only tie. People in these communities use fuelwood, fish, and game for part of their subsistence. Recreation (often roaded and/or motorized) is also a central component of the life styles in these communities. Therefore, the provision of diverse recreation opportunities on the Forest is also a major concern.

Rural Recreation and Residential Communities

Rural recreation and residential communities adjacent to, and within, the Deschutes National Forest are dependent primarily upon forest based recreation activities and recreation residences for their livelihood. Environmental and scenic amenities and nearby recreational opportunities are major reasons for their existence. Towns and settlements along the Metolius River and the upper Deschutes River, such as LaPine and Sisters, are included in this community type. Local service-oriented businesses provide convenience items and cater to tourists, skiers, and sportsmen.

Management activities which result in changes in the environmental quality, or appearance of the forest setting, amenities, and recreation opportunities all could have direct impacts on these communities.

Central Oregon Urban Center

This community type includes Bend which is the dominant community in the Forest Influence Zone. It has a large industrial sector based on wood products, and a large service sector keyed to recreationists and tourists. It is the major shopping and service center for outlying communities. The socioeconomic health of the wood products industry and the service sector, and the quality of the environment, are all central concerns to Bend's residents.

As a larger and more diverse community, some conflicts over Forest management can be absorbed without much social disruption. While more sensitive issues tend to pull people together within the smaller communities, they tend to polarize a community like Bend which has economic and emotional ties on all sides of the issues. The Deschutes National Forest, because of its amenities and economic contributions to Bend, renders it a Forest-dependent community.

Westside Communities

While activities on the Deschutes National Forest do not directly impact the daily lives of people in the populous communities west of the Cascades, they are important to many of them for various reasons. Over the last few years, more and more Deschutes National Forest timber sales have been purchased by the westside wood products industry. In addition, residents from the Willamette Valley participate in a wide diversity of recreational activities provided on the Deschutes National Forest.

These communities represent the more diffuse Regional publics which are affected by management decisions on the Deschutes National Forest. Conflicts over resource management decisions on the Deschutes National Forest are more likely to be seen as symbolic of broader issues. Responses may reflect the position of specific interest groups rather than the sentiment of local residents who are more directly affected by the issues.

CHAPTER IV

ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter provides the scientific and analytic basis for the comparison of alternatives presented in Chapter II. Environmental consequences are discussed in short- and long-term and occasionally by decade. A plan for any alternative would last 10 to 15 years. Effects beyond the first decade are to look at long-term implications and explore the potential, if an alternative were implemented beyond the first decade.

The reasons for, and causes of, environmental effects of the alternatives, and the interrelationships between resources, land uses, and environmental conditions are presented here. The discussion also indicates the basis for, or source of, some estimates, and directs the reader to other places in the document where more information on a topic is available.

Because extensive quantitative information about effects is available in the tables in Chapter II (particularly in Tables II-3a and II-3b), the outputs and environmental effects may not be repeated in as much detail in this Chapter. The material in Chapter IV explains the relationships between resource outputs and environmental qualities and consequences. It includes, where relevant, the ties between quantitative and qualitative aspects of the information.

The net public benefits related to the existence and management of the Deschutes National Forest are generated from Forest-based resources for which either market or assigned dollar values can be determined (i.e., range, recreation, and timber), as well as from resources and forest conditions for which meaningful prices can not be associated (i.e., lifestyles, scenic quality, water quality, etc.). These latter nonpriced benefits are composed of both quantifiable and qualitative outputs and effects. A familarity with the priced benefits as well as both quantifiable and qualitative nonpriced benefits is crucial in order to obtain a better understanding of the environmental consequences and the net public benefits associated with each proposed alternative. A more detailed discussion of both priced and nonpriced benefits and their relationship to net public benefits is presented in Chapter II and Appendix B. In this Chapter, the environmental consequences associated with the provision of these benefits are discussed.

Identification of Consequences

Assumptions Used to Predict Changes

The following environmental variables are addressed because of NFMA direction, Regional Guide direction, and a need to respond to the issues and concerns.

The analysis considers effects during the first two decades to be short-term and those during the third through fifth decades to be long-term. Some assumptions used to predict outputs and activities, and their associated effects, follow.

General

The Standards and Guidelines, presented in Chapter V of the Proposed Forest Plan and in Appendix D of this document, would be followed for all Alternatives. They provide the necessary environmental protection and mitigation measures for all Alternatives.

Timber

The Forest Planning Model (FORPLAN) was used to analyze and develop alternative timber harvest schedules. The harvest levels and their associated schedule of timber management activities are a function of the following:

1) An objective function of maximizing the present net value of the timber resource.

2) The assignment of forested acres to alternative management prescriptions and their associated timber yield tables which reasonably reflect the volume and growth of stands of trees. Rotation lengths for the range of prescriptions available to the model are based on 95 percent of culmination

of mean annual increment, or extended rotation lengths needed to achieve other multiple use objectives other than the growing and harvesting of timber.

3) Temporal and spatial harvest flow constraints used to help achieve various multiple use goals associated with each alternative.

4) Economic costs and values based on recent observations and transactions regarding timber management on the Forest.

5) An assumption that the mountain pine beetle epidemic in the lodgepole pine working group will continue at current levels until the period of 1995 to 2000.

Appendix B provides a much more detailed discussion of the FORPLAN model and the timber harvest scheduling process.

Recreation

Capacity varies by Management Area. Acres of various Management Areas describe recreation opportunity. Recreation visitor days (RVD's) per year by Management Area are a measure of recreation use levels. The projected use levels are a function of the carrying capacity of a specific type of Management Area, estimated season of use, day and overnight use pattern, length of stay pattern, and projected population trends for the State of Oregon.

Wildlife

Population estimates for the management indicator species assume that the amount of habitat available is the limiting factor for a species. If amounts of habitat change, population levels will change. The habitat available is assumed to be suitable. Management indicator species are discussed throughout this Chapter and are also included in Chapter II.

Fire

The fire management effectiveness index (FMEI) evaluates how the alternatives would affect fire, assuming that we have a stable fire organization. The formula is: Fire Organization plus Fire Suppression Dollars plus Net Value Change Dollars equals FMEI divided by M Acres Protected.

Water

Traditionally, the effects of alternative land management activities on water are expressed by projecting changes in sediment rates or streamflow over time. Topographic and other physical characteristics of the Deschutes National Forest are such that, even under the worst of conditions, problems resulting from sedimentation and runoff are minimal.

The Deschutes is a remarkably forgiving Forest--slopes are gentle and soils are very porous[1]. While there are localized road erosion problems, there are very few documented instances of accelerated surface erosion or stream sedimentation and cumulative effects are not of significance.[2] Problems do occur under severe conditions such as rain on frozen ground or rapid snowmelt. The Forest is actively treating road network drainage problems which cause the greatest amount of erosion and sedimentation.[3] These problems occur on a small percentage of the Forest and are not common on a Forest-wide basis. Best management practices, which include proper road location and design and streamside management prescriptions, are utilized to protect against accelerated erosion or sediment problems.

Streamflow on the Deschutes National Forest generally originates from deep-seated springs. As such, streamflow is very stable and is not subject to frequent flooding.[4] Other than under severe conditions, such as rain-on-snow, streams on the Deschutes National Forest are rarely high enough to overtop their banks. Channel stability on the Deschutes National Forest, evaluated in terms of bank slope, vegetative cover, cutting, deposition, and debris, is "good" or "fair" with some zones of

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[1] Larsen, Daniel M. Soil Resource Inventory, Deschutes National Forest, Pacific Northwest Region, 1976.

[2] Hughes, Dallas. Letter (2500) documenting service trip. October 9, 1984. Regional Office, Pacific Northwest Region.

[3] McCammon, Bruce. Hydrologic Investigation of the Effects of Timber Harvesting and Road Construction within Watersheds Tributary to the Metolius River. Deschutes National Forest, Pacific Northwest Region, 1984.

[4] McCammon, Bruce. Prediction of Flood Magnitude and Frequency on the Deschutes National Forest (a) and Streamflow Summary of the Deschutes National Forest (b). Deschutes National Forest, Pacific Northwest Region, 1979.

"excellent".[5] Streams flowing through permanent range which has been grazed over the last several decades are in good shape and exhibit little of the traditional problems associated with cattle grazing[6] (loss of cover, channel widening, loss of banks.) Stream temperatures are cold—outflow from spring vents is characteristically between 40 and 45 degrees Fahrenheit and downstream temperatures rarely exceed 70 degrees.[7] Best management practices are used to maintain streamside vegetation and channel stability whenever a management activity is proposed along a stream or lake.

Since the Deschutes National Forest does not exhibit the traditional sediment, temperature and flooding problems which are common on most other Forests, it was determined that assessing the overall change in total annual water yield would be sufficient to show the effects of the Alternatives.

Soil Risk

Soils in areas where there are frost pockets, droughty conditions, rockiness, or wetness are more sensitive to management than soils without these conditions. These limitations are important during timber harvesting and reforestation.

The soil risk number expresses the number of suitable acres per decade where any type of timber management activity is occurring on soils with some degree of management limitation. The number of acres with timber harvest activities on soils with management limitations can be estimated by multiplying the values shown in Table II-3a by 10,000.

Other Activities

Certain other activities do not significantly affect the environment. They include many forms of recreation (such as hiking, fishing, cross country skiing), fence construction, wildlife and livestock water developments, and installation of small microwave and electronic sites.

Environmental Effects

Overview

The discussions of the physical, biological, social, and economic effects in this Chapter are designed to give more of the types of consequences that need to be considered and their inter-relationships rather than a detailed comparison of their magnitudes as is shown in Chapter II. However, the anticipated duration and significance of the outputs and effects are discussed here too.

The following sections are divided into discussions of effects (1) that do not vary significantly between alternatives and resources and (2) those that do vary significantly between alternatives and resources.

All of the outputs and effects are estimated in a consistent manner for each of the alternatives. Many of the outputs and effects are directly related to the amount of timber management and road construction activities that are scheduled to occur in each alternative. Of these activities, Alternative C has the most and Alternative G has the least. (See Table IV-1). In addition, some of the effects are short term while others are long term, (looking beyond the 10-15 year life of a plan) and some are direct while others are indirect consequences of a proposed management activity. While the frequency or likelihood of an output or effect occurring may vary between alternatives (depending on the amount of related activities proposed), the consequences may not be significantly different between the alternatives due to the low sensitivity of the resources involved or due to the common application of Standards and Guidelines across all alternatives. The Standards and Guidelines, which are detailed for each resource in the accompanying Forest Plan, are the governing protective and mitigating measures for management activities. On the other hand, the consequences of some outputs and activities can not be mitigated through the application of Standards and Guidelines and significant differences do occur between alternatives and need to be addressed.

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[5] Satterthwaite, Thomas. Unpublished Field Evaluations of Channel Stability. Deschutes National Forest, Pacific Northwest Region, 1979.

[6] Hughes, Dallas. Letter (2540) dated September 10, 1982. Regional Office, Pacific Northwest Region.

[7] McCammon, Bruce. Numerous Technical Reports and Summaries on Water Quality Monitoring, Deschutes National Forest, Pacific Northwest Region, 1978-1985.

Effects That Do Not Vary Significantly Among Alternatives or Resources

Cultural Resources - Timber harvesting and road construction activities have the greatest potential for disturbing cultural resources. In the short term (next 20 years), Alternative C affects the most acres and Alternative G the fewest. All of the other alternatives lie within a relatively narrow mid-range in terms of their potential disturbance to cultural resources (See Table IV-1).

Cultural resources will be protected in all alternatives through the application of standards and guidelines which apply to all management activities with the potential to disturb inventoried sites. This will include a professionally supervised inventory program, an evaluation of all inventoried sites, and the mitigation of all sites that may be impacted by ground disturbing activities. See Table IV-1.

Caves - The Forest has a large number of lava tubes and caves. The protection and management of these caves will be the same in all Alternatives. Potential impact will be commensurate with the amount of acres that are being accessed and developed by the timber program.

In the short term, mitigation measures would include avoiding disturbing activities at the entrance of caves and in the long term would include blocking cave entrances and interpreting caves.

Soils and Water - Like cultural resources, the potential impacts to the soil and water resources are based on the amount of ground disturbing activities (timber harvesting, road construction, prescribed burning) proposed in each Alternative.

The potential for impacts to water quality and soil productivity will be evaluated on a project-by-project basis to indicate short-term effects and the potential for significant, long-term, cumulative effects of past and proposed projects within the drainage.

Soil productivity and water quality will be protected in all alternatives through the application of standards and guidelines which apply to all management activities. Examples of mitigation measures include directional falling of timber to protect channel stability, uneven-age management of timber in streamside zones to provide needed shade, and proper road drainage to prevent excessive road runoff and erosion. See Table IV-1.

Threatened and Endangered Plant and Animal Habitat - Existing habitat for threatened and endangered species of animals and plants is protected in all alternatives through the application of either standards and guidelines or appropriate management prescriptions. All alternatives meet or exceed bald eagle management goals as defined by the interim Bald Eagle Recovery Plan, and all alternatives meet the spotted owl objectives. If habitat for peregrine falcons or wolverines is confirmed, it will be protected through the application of appropriate standards and guidelines. Sensitive plant habitat is also protected equally in all alternatives. Types of mitigation actions in the short term could include avoiding habitats for threatened or endangered plants and animals, seasonal restrictions, or the development of prescriptions to improve long-term conditions.

Pesticides - The Forest Service is currently enjoined from using any herbicides as a result of a court decision on the Regional Environmental Statement on pesticide use. That document is being revised and any chemical pesticide use on the Forest which would include big game repellent (BGR), gopher control (strychnine alkaloid), various herbicides and insecticides will be governed by an approved Regional EIS on pesticide use. Only the magnitude of pesticide use will vary between alternatives in direct proportion to the amount and intensity of timber management activities.

Fire - In each alternative, all wildfires will receive appropriate suppression response. Those alternatives that have higher proposed levels of timber harvesting and prescribed burning to improve wildlife habitat will have correspondingly lower long-term fire hazards through fuels reductions. However, the potential incidences of fires getting out of control may increase in the short term since weather conditions influencing fire control are not 100 percent predictable.

Air Quality - Other than prescribed burning, the temporary emission sources from forest management are not considered significant. The Forest will comply with all applicable air quality laws and regulations and coordinate with appropriate regulatory agencies. All Federal and State air quality standards will be adhered to in all alternatives. Smoke from prescribed burns on the Forest is the most controllable variable affecting air quality. Burning would be done under atmospheric conditions that encourage the dispersal of smoke and help to avoid air quality degradation due to smoke in populated areas. Occasional short-term pollution may occur for a few days since weather conditions are not 100 percent predictible. Those alternatives which propose more timber harvesting will tend to have more short-term incidences of reduced visibility. However, in the long-term, continual increased utilization of wood fiber will ultimately have the effect of reducing air pollution from prescribed fires.

Dust created from vehicle traffic on roads can also contribute to poor air quality. It can be mitigated by watering roads.

Prime Farmlands - There are no prime farmlands within or adjacent to the Forest. Water from the Forest is used to irrigate pasture and farmland in Central Oregon but none of the Alternatives significantly affect the quality or quantity of water.

Wetlands and Floodplains - There are very few acres of wetlands on the Forest. Wetlands and floodplains are protected equally in all alternatives through the application of standards and guidelines designed to maintain infiltration capacity of floodplains and to provide for rapid treatment of slash in floodplain areas.

Noise - Noise is not a significant environmental factor in any of the alternatives. Most of the noise would be associated with timber harvesting and would be localized and not continuous. In the long term, increases in noise could be associated with geothermal resources (within a half mile).

Recreational vehicles and motorboat use occurring in a concentrated area can be noisy.

Minerals - The potential for locatable minerals on the Forest is very low. Any environmental consequences would be localized and be confined to soil disturbance and changes in visual quality. Removal of any minerals would be an irreversible loss of resources.

Effects on Resources that Do Vary Among Alternatives

Vegetation

Timber

General Activities

Timber management is comprised of a number of related silvicultural activities associated with the establishment, tending, harvesting and marketing of wood products from the National Forest. It is the primary means of manipulating the vegetative resources on the Forest to achieve the desired management objectives for timber, range, recreation, wildlife, and visual resources.

Silvilcultural activities which affect the environment include site preparation, reforestation, plantation protection against animal damage, timber stand improvement including modification of competitive vegetation and thinning, and the harvesting of timber crops. Other activities that are associated with the management of timbered stands include construction and maintenance, logging operations, and the removal of residual fuels resulting from harvesting activities.

The magnitude of the effects, both short-term and long-term and direct and indirect, depend upon the type of activities prescribed and the number of acres to which they are applied. All vegetative management activities are implemented in accordance with the prescriptions and the standards and guidelines detailed in the Forest Plan.

Most silvicultural practices on the Forest are implemented with the intent to perpetuate the growth and development of even-aged stands of timber, although in some cases the management of uneven-aged stands is also appropriate. See Appendix I for more information.

Consequences on Alternatives

Timber management and other associated activities occur in each alternative. However, the amount of activities prescribed and their consequential environmental effects do vary from one alternative to another. Alternatives B (RPA), C, D, E (Preferred), and H all meet or exceed the cubic foot wood outputs of the Current Direction Alternative (Alt. A) for the first five decades. Alternative C is the only alternative which meets or exceeds the National RPA and State Forestry Program for Oregon (FPFO) wood output targets for the first five decades. However, Alternatives B and E (the Preferred Alternative) meet or exceed all of the RPA targets and at least some of the short term FPFO targets.

Table IV-1 displays for each alternative the average annual acres of timber harvesting and miles of road construction. While this is not the total picture as far as timber management related activities are concerned, it does provide a good means of comparing the relative potential magnitude of environmental consequences that may result from the implementation of any one alternative. As can be seen, in the first decade Alternative C could impact the largest amount of land while Alternative A (Cur.Dir.) affects the least. In the second decade, and on through the fifth, Alternative G has the lowest potential to impact acres with vegetative management activities.

The number of acres impacted in each alternative is primarily a function of (1) the amount of volume offered for sale in each decade; (2) the rate at which mature and overmature lodgepole pine stands are converted to young managed stands in order to alleviate future losses to the mountain pine beetle epidemic; and (3) the proportionate share of the allowable sale quantity that is comprised of thinning volumes.

Table IV-2 displays the allowable sale quantity in board feet by working group and diameter class for each alternative. Alternative C offers the highest allowable sale quantities while Alternative G offers the lowest over the first two decades. It is also apparent that Alternative C proposes conversion of more lodgepole pine over the next two decades than any other alternative, while Alternative G converts the least. In the short term, these two factors account for Alternative A (Current Direction) impacting more land with timber management and road construction and maintenance activities than any other alternative, while Alternative G impacts the least. All of the other Alternatives fall somewhere in between.

In the long-term, (what potentially could happen if an alternative were carried beyond the life of a plan which is 10-15 years) the amount of commercial thinning that comprises the allowable sale quantity will also affect the amount of land impacted annually by timber management related activities. This begins to show up in Decade 5 of Table IV-1 and Table IV-2 but does not become a significant factor until Decades 6, 7, and 8. In all of the Alternatives,

Table IV-1. Average Annual Acres of Timber Harvesting and Miles of Road Construction by Alternative

	Decade 1[1]			Decade 2			Decade 5[2]		
	Timber Harvesting		Road	Timber Harvesting		Road	Timber Harvesting		Road
Alternative	Regen. Harvest (M Acres)	Commercial Thinning (M Acres)	Construction & Reconstruction (Miles)	Regen. Harvest (M Acres)	Commercial Thinning (M Acres)	Construction & Reconstruction (Miles)	Regen. Harvest (M Acres)	Commercial Thinning (M Acres)	Construction & Reconstruction (Miles)
A (Cur.Dir.)	13.3	3.2	57	17.3	5.2	45	9.8	8.2	30
B (RPA)	20.6	3.9	53	13.8	4.7	55	11.6	10.8	45
C	24.8	4.4	77	17.3	4.4	82	11.6	11.6	62
D	19.5	3.8	51	13.8	4.7	55	10.6	11.4	47
E (Pref.)	21.3	4.1	60	15.3	4.5	57	11.1	11.8	47
F	17.6	3.7	52	14.2	4.5	48	10.3	9.0	39
G	14.4	2.8	46	11.9	4.5	38	8.2	9.5	26
H	17.9	5.2	54	15.9	5.5	44	10.7	15.9	32

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[1] First decade basically represents the life of a Plan for any alternative.

[2] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-2 Allowable Sale Quantity by Working Group and Diameter Class for Each Alternative (Average Annual MMBF)

		Ponderosa		Lodgepole		Mixed Conifer		Mountain Hemlock	
Alternative	Decade	5'-16''	>16''	5'-8''	>8''	5'-16''	16''	5'-16''	16''
A (Cur.Dir.)	1[1]	7.0	79.2	–	38.1	0.6	69.2	--	--
	2	15.3	6.0	–	99.2	–	44.8	--	--
	5[2]	18.3	59.8	0.6	–	0.5	151.7	--	--
B (RPA)	1	6.8	73.8	–	76.5	0.8	16.2	--	--
	2	10.0	33.2	--	57.1	–	103.0	--	--
	5	42.2	65.0	0.3	--	1.4	105.5	–	10.7
C	1	6.3	89.5	--	87.6	3.6	78.5	--	--
	2	9.4	71.9	–	66.9	–	115.0	–	0.1
	5	28.5	61.7	0.1	--	2.1	104.8	–	50.2
D	1	6.3	63.7	–	76.7	0.6	23.3	--	--
	2	10.7	47.0	–	51.8	–	90.6	--	--
	5	35.4	65.9	0.4	--	0.7	102.2	–	20.6
E (Pref.)	1	6.5	71.3	–	75.2	1.9	47.3	--	--
	2	10.8	54.2	–	65.3	–	75.1	–	3.2
	5	37.5	67.4	0.4	–	2.0	105.4	–	15.1
F	1	6.3	76.1	–	55.2	0.6	36.0	--	--
	2	9.2	19.7	–	71.6	–	77.1	–	--
	5	25.4	56.3	0.3	–	0.8	126.1	–	7.3
G	1	5.2	85.5	–	31.3	0.3	30.5	--	--
	2	23.1	16.1	–	39.2	–	75.8	–	--
	5	21.7	53.3	–	--	0.4	103.7	–	2.4
H	1	14.0	76.0	–	52.2	3.3	41.6	–	0.1
	2	21.3	29.2	–	75.1	–	51.2	–	0.1
	5	37.5	59.8	6.7	–	5.4	84.3	–	3.8

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[1] First decade basically represents the life of a Plan for any alternative.

[2] The fifth decade represents the potential if an alternative were continued for 5 decades.

the allowable sale quantity over the next four or five decades is predominantly made up of regeneration harvest volumes from mature and overmature larger diameter stands of trees (except for lodgepole pine). Beginning in the fifth decade and becoming more pronounced in the following decades, more and more of the allowable sale quantity volume will be from commercial thinnings of younger and smaller diameter stands of trees. This will require an increasing amount of acreage to be covered each year to yield equal amounts of harvest volumes.

Overall Effects of the Alternatives on Diversity

Table IV-3 shows the overall effect of each alternative on the vegetative diversity of the forest. The consequence of harvesting timber in each alternative is to convert the predominantly mature and overmature existing natural forest to a more vigorous, faster growing, younger, managed forest. In the long run, there will be a more uniform distribution of age classes than there is currently. An indirect effect of this increased vegetative diversity is the reduced risk of catastrophic insect and disease infestations. The higher the harvest levels would be in an Alternative, the sooner diversity will occur.

Consequences on Resources

Timber

Road construction associated with timber management represents a long-term commitment of Forest resources. Acreage dedicated to road systems is not available for production of trees or forage. This constitutes about .5 percent of the Forest. Timber harvesting and associated activities will compact soils on skid trails, log landings, and temporary roads. Soil will be displaced in areas where timber is harvested and residues are treated. These consequences will be localized and short-term, and can be mitigated. Standards and guidelines will be applied during and after these activities to prevent a reduction in site productivity.

Timber management activities will have other long-term effects on the timber resource. As the forest is converted from its existing natural stands to managed stands, volume growth will be increased. Also, the younger managed stands will be more vigorous, which will result in reduced risks of damage from insect and disease outbreaks. All of these long-term consequences will be realized sooner and to larger extents for alternatives which emphasize higher harvest levels.

Table IV-3 Percent of the Forest by Successional Stage and Plant Community

Plant Community	Existing Condition	Natural +50 Yrs.	(Cur.Dir) (A) +50 Yrs.	(RPA) B +50 Yrs.	C +50 Yrs.	D +50 Yrs.	(Preferred Alternative) E +50 Yrs.	F +50 Yrs.	G +50 Yrs.	H +50 Yrs.
Coniferous Forest:										
Stage I (grass/forb)	7	3	5	6	6	6	6	6	4	6
Stage II (shrub)	5	1	4	6	6	5	6	5	4	5
Stage III (saplings)	11	10	27	25	32	26	27	23	20	25
Stage IV (immature)	8	13	18	19	19	18	19	19	20	19
Stage V (mature)	20	17	18	17	14	16	17	18	19	18
Stage IV (old growth)	34	41	13	12	8	14	10	14	18	12
Juniper[1]	1	1	1	1	1	1	1	1	1	1
Meadows[1]	1	1	1	1	1	1	1	1	1	1
Brush Dominated[1]	1	1	1	1	1	1	1	1	1	1
Riparian[1]	1	1	1	1	1	1	1	1	1	1
Alpine	9	9	9	9	9	9	9	9	9	9
Rock and Talus	3	3	3	3	3	3	3	3	3	3

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[1] Less than 1 percent.

[2] No management, with fire uncontrolled.

Range

Timber management activities will alter the structure and composition of Forest plant communities. Timber harvesting can increase the amount of forage available for livestock, and increase its palatability and nutrient content. In this way, there is a direct relationship between the magnitude of timber harvesting activities and forage available for domestic livestock.

While in the short term, timber management activities may cause some soil disturbance and compaction they should not have lasting effects on the range resources of the Forest.

Wilderness and Roadless Areas

Road systems developed for timber management result in increased access to existing roadless areas which are often adjacent to Wildernesses. Increased access could change visitor use patterns in these areas. The potential to view and hear timber management activities from the Wilderness and roadless areas could also increase, thereby reducing the total Wilderness experience. Road construction and timber harvesting in roadless areas eliminate the Wilderness values associated with them and therefore eliminate options for future Wilderness considerations. Those not developed would be available for evaluation as Wilderness when a plan is revised. See Tables IV-4a through IV-4k and Appendix C for more information.

Recreation

Timber management activities will change the recreational opportunities available to the Forest visitor. Indirect effects of increased timber management activities are increased opportunities for motorized dispersed recreation and the increased opportunity for winter recreation.

Through the application of appropriate prescriptions and their associated standards and guidelines, vegetative management in developed recreation areas can have the long-term effect of improved visual quality for recreation settings.

Scenic Quality

Timber management activities will change the visual appearance of the Forest during both the short and long term. Forest visitors will experience a change in forest structure from the existing condition of natural stands with larger trees and mixed ages to a more uniform managed forest with smaller trees and less dead material. The rapid harvesting of dead and dying lodgepole pine will result in degradation of visual quality along roads and in and adjacent to recreation areas. Cutting units with slash piles, stumps, and bare ground will be readily apparent in the short term.

Through the application of the appropriate prescriptions and their associated standards and guidelines, vegetative management in sensitive visual areas can have the long-term effect of enhanced visual quality.

Wildlife Habitat

Timber harvesting makes more forage available for deer and elk. It can also reduce hiding cover in the short term. This can be mitigated by leaving screens, slash piling, or restricting human activity.

With the accelerated program for lodgepole pine and the many acres which are planned for harvesting during the next 10 years, the cumulative effect on National Forest, private, and BLM lands could be that cover on large areas would be reduced. This will be mitigated through coordination with other ownerships and may require the delaying of harvests on some National Forest lands until cover is available on adjacent lands.

Timber harvesting activities also reduce the natural habitat for cavity dependent species. Alternative C

Table IV-4a Summary of Waldo Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	4992	4992	4992	4992	4992	4992	4992	4992
Acres Available for Development	1584	2352	3584	3877	2352	2807	2341	2384
Acres Unavailable for Development[1]	3408	2640	1408	1115	2640	2185	2651	2608
Acres Available for Winter Recreation/Geothermal[2]	0	0	0	0	0	0	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	0	0	95	128	0	0	0	5
Decade 3	0	0	0	0	0	79	0	5
Decade 4	0	69	470	139	69	0	251	251
Decade 5[7]	0	42	5	305	159	42	267	213
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.00	0.00	.95	1.28	0.00	0.00	0.00	0.05
Decade 5	0.00	1.11	5.70	5.72	2.28	1.21	5.18	4.74
Acres Remaining Undeveloped After:[5]								
Decade 1	4992	4992	4992	4992	4992	4992	4992	4992
Decade 2	4992	4992	4897	4864	4992	4992	4992	4987
Decade 3	4992	4881	4422	4420	4764	4871	4474	4518

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be some higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impact geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some develop that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4b: Summary of Charlton Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	7243	7243	7243	7243	7243	7243	7243	7243
Acres Available for Development	624	460	6731	6731	3931	449	80	80
Acres Unavailable for Development[1]	6619	6783	512	512	3312	6794	7163	7163
Acres Available for Winter Recreation/Geothermal[2]	0	0	0	0	0	0	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	58	63	998	619	581	53	0	
Decade 3	0	0	0	0	90	0	0	0
Decade 4	0	0	181	0	1431	0	0	0
Decade 5[7]	0	0	3402	2785	542	0	0	0
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.58	0.63	9.98	6.19	5.81	0.53	0.00	0.79
Decade 5	0.58	0.63	45.81	34.04	26.44	0.53	0.00	0.79
Acres Remaining Undeveloped After:[5]								
Decade 1	7243	7243	7243	7243	7243	7243	7243	7243
Decade 2	7185	7180	6245	6624	6662	7190	7243	7164
Decade 3	7185	7180	2662	3839	4599	7190	7243	7164

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4c: Summary of Bearwallows Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	7337	7337	7337	7337	7337	7337	7337	7337
Acres Available for Development	1050	7337	7337	7337	7337	7337	1230	1230
Acres Unavailable for Development[1]	6287	0	0	0	0	0	6107	6107
Acres Available for Winter Recreation/Geothermal[2]	0	1157	0	0	1157	1157	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	42	203	4717	3382	3700	3455	0	647
Decade 3	0	0	0	0	11	0	0	354
Decade 4	0	0	0	0	0	395	0	160
Decade 5[7]	203	2219	2249	1963	2219	2517	165	5
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.42	2.03	47.17	33.82	37.00	34.55	0.00	6.47
Decade 5	2.45	24.22	69.66	53.45	59.30	63.67	1.65	11.66
Acres Remaining Undeveloped After:[5]								
Decade 1	7337	7337	7337	7337	7337	7337	7337	7337
Decade 2	7295	7134	2620	3955	3637	3882	7337	6690
Decade 3	7092	4915	371	1992	1407	970	7172	6171

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4d: Summary of Bend Watershed Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	14,250	14,250	14,250	14,250	14,250	14,250	14,250	14,250
Acres Available for Development	2,837	5,072	10,746	7,172	4,960	5,569	2,160	2,160
Acres Unavailable for Development[1]	11,413	9,178	3,504	7,078	9,290	8,681	12,090	12,090
Acres Available for Winter Recreation/Geothermal[2]	0	2,368	7,941	0	3,920	3,989	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	0	0	0	0	0	0	0	141
Decade 3	0	0	31	0	31	0	0	80
Decade 4	0	0	0	278	0	0	0	1
Decade 5[7]	600	1,358	1,290	1,247	324	461	744	1,071
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41
Decade 5	6.00	13.58	13.21	15.25	3.55	4.61	7.44	12.93
Acres Remaining Undeveloped After:[5]								
Decade 1	14,250	14,250	14,250	14,250	14,250	14,250	14,250	14,250
Decade 2	14,250	14,250	14,250	14,250	14,250	14,250	14,250	14,109
Decade 3	13,650	12,892	12,929	12,725	13,895	13,789	13,506	13,957

[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4e: Summary of West-South Bachelor Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	30,945	30,945	30,945	30,945	39,945	30,945	30,945	30,945
Acres Available for Development	11,430	18,837	30,945	30,945	29,958	11,305	7,814	10,555
Acres Unavailable for Development[1]	19,515	12,108	0	0	987	19,910	23,131	20,390
Acres Available for Winter Recreation/Geothermal[2]	0	6,773	7,248	8,992	12,785	0	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	117	0	159	15	15	86	0	5
Decade 3	0	0	0	0	69	3	0	79
Decade 4	779	0	9,450	230	837	958	5	310
ecade 5[7]	1,181	8	3,827	2,583	3,410	1,389	125	1,731
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	1.17	0.00	1.59	0.15	0.15	0.86	0.00	1.05
Decade 5	20.77	0.08	134.36	28.28	43.31	24.36	1.30	21.25
Acres Remaining Undeveloped After:5								
Decade 1	30,945	30,945	30,945	30,945	30,945	30,945	30,945	30,945
Decade 2	30,828	30,945	30,786	30,930	30,930	30,859	30,945	30,940
Decade 3	38,868	30,937	17,509	28,117	26,614	28,509	30,815	28,820

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4f: Summary of Maiden Peak Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	27,008	27,008	27,008	27,008	27,008	27,008	27,008	27,008
Acres Available for Development	12,837	11,440	27,008	24,315	14,484	10,928	2,154	2,178
Acres Unavailable for Development[1]	14,171	15,568	0	2,693	12,524	16,080	24,854	24,830
Acres Available for Winter Recreation/Geothermal[2]	0	0	0	0	0	0	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	0	149	635	508	538	149	0	0
Decade 3	230	0	0	0	333	0	0	337
Decade 4	0	0	4,954	3	1,333	0	0	0
Decade 5[7]	171	5,427	15,676	5,804	6,514	3,782	334	619
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.00	1.49	6.35	5.08	5.38	1.49	0.00	0.00
Decade 5	4.01	55.76	212.65	63.15	87.18	39.31	3.34	9.56
Acres Remaining Undeveloped After:[5]								
Decade 1	27,008	27,008	27,008	27,008	27,008	27,008	27,008	27,008
Decade 2	27,008	26,859	26,373	26,500	26,470	26,859	27,008	27,008
Decade 3	26,607	21,432	5,743	20,693	18,290	23,077	22,743	26,052

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4g: Summary of North Paulina Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	21,622	21,622	21,622	21,622	21,622	21,622	21,622	21,622
Acres Available for Development	20,907	17,462	21,622	17,531	17.606	21,611	2,171	10,069
Acres Unavailable for Development[1]	715	4,160	0	4,091	4,016	11	19,451	11,553
Acres Available for Winter Recreation/Geothermal[2]	0	261	4,107	0	0	0	0	4,469
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	0	180	6,183	626	42	31	0	264
Decade 3	5,051	0	143	0	6,734	0	0	1,938
Decade 4	36	186	579	298	648	123	0	0
Decade 5[7]	0	0	1,879	0	395	0	0	528
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.00	1.80	61.83	6.26	0.42	0.31	0.00	2.64
Decade 5	50.87	3.66	87.84	9.24	78.19	1.54	0.00	27.30
Acres Remaining Undeveloped After:[5]								
Decade 1	21,622	21,622	21,622	21,622	21,622	21,622	21,622	21,622
Decade 2	21,622	21,442	15,439	20.996	21,580	21,591	21,622	21,358
Decade 3	16,535	21,256	12,838	20,698	13,803	21,468	21,622	18,892

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4h: Summary of South Paulina Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	9,915	9,915	9,915	9,915	9,915	9,915	9,915	9,915
Acres Available for Development	9,648	9,915	9,915	6,603	6,661	9,915	432	1,589
Acres Unavailable for Development[1]	267	0	0	3,312	3,254	0	9,483	8,326
Acres Available for Winter Recreation/Geothermal[2]	0	3,243	3,131	0	0	0	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	0	1,997	2,491	245	138	937	0	0
Decade 3	2,707	0	0	0	2,604	0	0	764
Decade 4	204	0	0	0	0	302	0	0
Decade 5[7]	0	210	1,093	21	396	202	0	20
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.00	19.97	24,91	2.45	1,38	9.37	0.00	0.00
Decade 5	29.11	22.07	35.84	2.66	31.38	14.41	0.00	7.84
Acres Remaining Undeveloped After:[5]								
Decade 1	9,915	9,915	9,915	9,915	9,915	9,915	9,915	9,915
Decade 2	9,915	7,918	7,424	9,670	9,777	8,978	9,915	9,915
Decade 3	7,004	7,708	6,331	9,649	6,777	8,474	9,916	9,131

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4i: Summary of Mt. Jefferson Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	2,608	2,608	2,608	2,608	2,608	2,608	2,608	2,608
Acres Available for Development	2,224	2,608	2,608	2,608	2,608	2,608	117	2,608
Acres Unavailable for Development[1]	384	0	0	0	0	0	2,491	0
Acres Available for Winter Recreation/Geothermal[2]	0	0	0	0	0	0	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	0	0	911	188	618	0	0	0
Decade 3	0	0	0	0	26	0	0	0
Decade 4	0	0	0	0	0	0	0	730
Decade 5[7]	810	774	177	733	435	735	0	0
Cumulative Miles of Road Construction:4								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.00	0.00	9.11	1.88	6.18	0.00	0.00	0.00
Decade 5	8.10	7.74	10.88	9.21	10.79	7.35	0.00	7.30
Acres Remaining Undeveloped After:[5]								
Decade 1	2,608	2,608	2,608	2,608	2,608	2,608	2,608	2,608
Decade 2	2,608	2,608	1,697	2,420	1,990	2,608	2,608	2,608
Decade 3	1,798	1,834	1,520	1,687	1,529	1,873	2,608	1,878

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4j: Summary of Metolius Breaks Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	10,907	10,907	10,907	10,907	10,907	10,907	10,907	10,907
Acres Available for Development	3,163	3,324	10,907	10,907	3,324	4,428	3,152	3,152
Acres Unavailable for Development[1]	7,744	7,583	0	0	7,583	6,479	7,755	7,755
Acres Available for Winter Recreation/Geothermal[2]	0	0	0	0	0	0	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	
Decade 2	0	3,920	0	0	0	0	0	0
Decade 3	0	0	0	0	0	0	0	0
Decade 4	164	384	2,165	405	384	0	384	730
Decade 5[7]	166	325	360	427	325	325	346	0
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.00	0.00	39.20	0.00	0.00	0.00	0.00	1.41
Decade 5	3.31	7.09	64.45	8.32	7.09	3.25	7.30	7.30
Acres Remaining Undeveloped After:[5]								
Decade 1	10,907	10,907	10,907	10,907	10,907	10,907	10,907	10,907
Decade 2	10,907	10,907	6,987	10,907	10,907	10,907	10,907	10,907
Decade 3	10,576	10,198	4,462	10,075	10,198	10,582	10,177	10,177

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

Table IV-4k: Summary of Three Sisters Roadless Area Development by Alternative

	(CD) Alt. A	(RPA) Alt. B	Alt. C	Alt. D	(Pref.) Alt. E	Alt. F	Alt. G	Alt. H
Total Unroaded Acres	8315	8315	8315	8315	8315	8315	8315	8315
Acres Available for Development	6163	6667	8315	7504	6667	6662	91	4715
Acres Unavailable for Development[1]	2152	1648	0	811	1648	1653	8224	3600
Acres Available for Winter Recreation/Geothermal[2]	0	400	843	0	400	443	0	0
Acres of Timber Harvest:[3]								
Decade 1[6]	0	0	0	0	0	0	0	0
Decade 2	0	0	0	0	0	0	0	0
Decade 3	0	0	0	0	0	0	0	0
Decade 4	0	0	0	0	0	0	0	0
Decade 5[7]	0	0	0	0	0	0	0	0
Cumulative Miles of Road Construction:[4]								
Decade 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decade 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Decade 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acres Remaining Undeveloped After:[5]								
Decade 1	4992	4992	4992	4992	4992	4992	4992	4992
Decade 2	4992	4992	4992	4992	4992	4992	4992	4992
Decade 3	4992	4992	4992	4992	4990	4992	4992	4992

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[1] Includes management strategies which primarily exclude roading such as Research Natural Areas, some forms of undeveloped recreation, and the Bend Municipal Watershed.

[2] The acres assigned to the winter recreation and geothermal strategy are available for roading but it is difficult to predict when that would occur since it is dependent upon leasing and exploration. Some exploration could be expected in the first decade but it is impossible to say how much and where.

[3] The acres scheduled for timber harvest would also have associated roads so that total acres impacted would be somewhat higher than shown above.

[4] Based on a coefficient of .01 miles of collector and local roads per acre harvested. The unpredictable impacts of geothermal exploration and development are not included.

[5] Includes only the impacts of scheduled timber harvesting. Does not consider geothermal exploration or some development that might occur because of the mountain pine beetle epidemic in lodgepole pine.

[6] First decade basically represents the life of a Plan for any alternative.

[7] The fifth decade represents the potential if an alternative were continued for 5 decades.

retains habitat for 20 percent of the maximum biological potential for cavity nesters while Alternative G retains habitat for 80 percent of the maximum biological potential. Alternative E (Preferred Alternative) provides habitat for cavity dependent species at 60 percent of maximum biological potential. As timber harvesting increases, wildlife populations associated with mature and old growth stands will decrease and wildlife populations associated with younger stands will increase. Refer to Chapter II, Table II-3a for specific effects on management indicator species.

Finally, since no Alternative eliminates any plant communities, no wildlife species associated with them are eliminated.

Old Growth

Timber harvesting activities directly impact the acreage remaining in old growth. However, all Alternatives result in at least some old growth being maintained in the long term. See Table IV-3.

Social and Economic

Many communities in Central Oregon and surrounding regions of the State are dependent upon the timber harvested from the Deschutes National Forest for their livelihood. Ponderosa pine and associated mixed conifer species have traditionally been the primary commercial species for processing in the local mills. However, in the last five to ten years, markets for lodgepole pine studs, chips, and firewood have also developed.

The harvesting of timber from National Forests also has a direct effect on the revenues of local, State and County Governments, since 25 percent of Forest Service stumpage receipts is returned to these governing bodies in lieu of taxes.

Timber harvesting is also an integral component of the Central Oregon way of life. Many of the local communities grew up around the wood products industries which depended upon National Forest timber. However, in recent years the dominance of the wood processing sectors in the economy has begun to be eroded away by the growing recreation dependent service sectors. While wood processing will continue to be an important element of the local economies and way of life, the increasing role of the recreation based service sectors and other new industries currently being introduced into the area will lead to a more diverse economy in the long run.

Each alternative proposes a different harvest level and mix of species. The more timber an alternative offers for sale, particularly ponderosa pine and mixed conifer species, compared to the Current Direction Alternative (Alt. A), the more potential there is for the wood processing sectors and their associated social environments to thrive in the local communities. Refer to Table IV-2 and Table ii-3a for more details regarding the wood outputs and economic effects of each alternative.

Range

General Activities

Activities include water developments, prescribed burning, fence construction, and grass seeding.

Consequences on Alternatives

Alternatives B (RPA), C, E (Pref.), and H meet the RPA Program and increase from current levels. Alternatives A (Cur.Dir.), D, and F maintain grazing at current levels. Alternative G decreases from current levels.

Environmental consequences described below are the same for each Alternative. However, in those Alternatives where high grazing levels are proposed, more acres will be affected. No Alternatives have a grazing level high enough to create a significant problem. See Table IV-5.

Table IV-5 Animal Unit Months by Alternative and Decade (in thousands)

	CD A	RPA B	C	D	Pref. E	F	G	H
MAUM's								
Decade 1	29	32	45	29	32	29	26	32
Decade 2	29	36	45	29	36	29	26	36
Decade 5	29	45	45	29	45	29	26	45

Consequences on Resources

Range

Livestock grazing affects plant vigor and composition, but use levels would not be high enough to cause detrimental long term effects. Within allotments, livestock compact soils around salt licks and water sources, causing these areas to appear trampled and abused.

Timber

Cattle and sheep can damage tree plantations in the short term by eating trees or trampling and breaking them. This affects the long term growth and vigor of the tree. This can be mitigated by increasing investments to protect plantations.

Wilderness/Roadless

No additional grazing is proposed in any alternative in Wilderness. Currently, grazing is allowed on one small allotment in the Three Sisters Wilderness; however, some pack animals are used for recreation experiences. There are a few allotments in roadless areas.

The sight and residues of livestock can detract from the Wilderness experience for some visitors. Non-native plant species can be introduced into the Wilderness by recreation livestock.

Recreation

Livestock grazing does not significantly affect recreation resources. Generally, grazing and recreation do not occur in the same areas.

Scenic Quality

The livestock grazing program has no significant impact on the visual resource.

Wildlife

Big game and livestock compete somewhat for forage. The more livestock or big game, the more potential there is for competition. For the most part, cattle and sheep grazing, when properly managed, can complement mule deer habitat by utilizing vegetation which would otherwise become rank and unpalatable.

Old Growth

In the long term, livestock grazing could alter the native vegetation in stands being managed for old growth characteristics. This can be mitigated by keeping salt licks and water sources away from old growth areas.

Social and Economic

Grazing allotments on National Forest land contribute to year round grazing for local ranches. The raising and selling of livestock contributes to the local and regional economies.

Livestock on National Forest lands potentially could stray onto private lands causing damage to trees or landscaping.

Recreation

General Activities

Recreation management includes activities such as operating and expanding existing recreation facilities (campgrounds, boat ramps, trails, signs, ski areas, and parking lots and interpretive centers), constructing of new facilities, providing access to National Forest land and water, and protecting visual resources.

Consequences on Alternatives

Opportunities to enjoy various types of developed and dispersed recreation vary significantly among alternatives.

Developed recreation opportunities would increase in some alternatives due to the construction of new recreation facilities. Day use facilities are emphasized in some alternatives while more overnight campgrounds would be developed in others. Alternative C provides the most new overnight campgrounds and encourages growth and demand. Alternative D emphasizes day-use rather than campground use. Alternatives B, E (Pref.), and F would develop enough campgrounds to meet long-term demands. Alternatives G and H would not meet this long term demand for developed recreation because they do not provide for enough new developed recreation sites and facilities. See Table IV-6.

Table IV-6 Number of Campground Units Constructed Per Year (Decade 1)

	Alternative							
	(CD) A	(RPA) B	C	D	(Pref.) E	F	G	H
Units	75	65	75	0	65	65	0	0

Dispersed recreation opportunities would substantially exceed demand in all alternatives. Those recreation opportunities associated with roads or those that occur in Roaded, Modified and the Roaded-Natural ROS zone will be particularly plentiful. This includes hunting, hunter camps, fishing, ORV use, nordic skiing, hiking, dispersed camping, etc.

Opportunities for dispersed recreation in unroaded areas or those that occur in the Semiprimitive Nonmotorized ROS zone will be significantly affected by all Alternatives. Table IV-7 displays acres of each ROS class by alternative. Alternative C would restrict such recreation opportunities to existing Wilderness and parts of the Oregon Cascade Recreation Area (OCRA). Alternative D would provide more opportunity for dispersed recreation in roadless areas than Alternative C, but people would still rely primarily on Wilderness and the OCRA. Both Alternatives C and D, however, would not meet long-term needs for Semiprimitive Nonmotorized recreation. Alternatives B (RPA), E (Pref.), and F provide more opportunities than C and D, due to the larger amount of land that would remain roadless. Alternatives G and H provide the most opportunities for dispersed recreation in unroaded areas. See Table IV-8.

Consequences on Resources

Recreation

Developed Recreation

Primitive and semiprimitive nonmotorized recreation opportunities would not be lost because they usually do not occur in developed recreation areas.

Overcrowding and site damage in some localized areas are possible if more developed sites are not provided. Overcrowding may cause soil erosion and water degradation in local areas. If the number of campground sites increases, more people living in urban environments will be able to enjoy a forest environment.

Dispersed Recreation

Dispersed campsites and other heavily used recreation areas may adversely affect soil and water in localized areas.

Prevailing soil, hydrological, and atmospheric conditions in unroaded areas would be maintained.

In areas managed in an unroaded condition, evidence of human influence and activities in unroaded areas would diminish rather than increase through time. The naturalness, uniqueness, and representative ecosystems, and a high level of visual quality, would be maintained in roadless areas. Educational opportunities for scientific study of natural ecological processes would increase.

Table IV-7 Acres of ROS Class by Alternative

	Alternative							
ROS Class	(CD) A	(RPA) B	C	D	(Pref.) E	F	G	H
Primitive	82,184	82,184	82,184	82,184	82,184	82,184	82,184	82,184
SPNM	145,731	145,951	143,045	143,851	145,126	145,992	149,397	148,803
SPM	10,899	11,769	268	3,456	8,505	11,931	25,409	23,056
RN	278,386	268,222	275,391	274,307	271,007	267,547	254,395	256,560
RM	1,059,998	1,065,573	1,058,850	1,056,368	1,062,744	1,065,044	1,071,015	1,069,207
Rural	40,414	43,913	57,874	57,446	48,046	44,915	35,213	37,802
Urban	28,00	28,00	28,00	28,00	28,00	28,00	28,00	28,00
Total	**1,620,412**	**1,620,412**	**1,620,412**	**1,620,412**	**1,620,412**	**1,620,412**	**1,620,412**	**1,620,412**

Table IV-8 Proposed Classification of Wild and Scenic Rivers

		Recommended by Alternative in Miles							
River	Considered Inventoried Miles	(Cur.Dir.) A	(RPA) B	C	D	(Pref.) E	F	G	H
Deschutes	53	0	53-R	0	53-R	17-R	0	36-R 17-S	36-R 17-S
Little Deschutes	97	0	0	0	97-R	0	0	97-R	97-R
Metolius	29	0	11-R[1]	0	29-R	11-R[1]	11-R	29-R	29-R
Big Marsh-Crescent Creek	41	0	0	0	0	0	0	41-R	41-R
Total		**0**	**65**	**0**	**180**	**29**	**11**	**221**	**221**

R =Recreation River Classification
S =Scenic River Classification
[1] =Recommendation deferred on additional 17 miles (Bridge 99 to Lake Billy Chinook) until Warm Springs Reservation Plan is completed.

Timber

Dispersed Recreation, Unroaded

Timber would not be available for harvest in unroaded recreation areas.

In the long term, areas managed for primitive or semiprimitive recreation would eventually reach the climax plant succession stage. Carefully designed vegetative manipulation, including timber harvest, would be required to enhance or maintain scenic quality in visually sensitive areas.

Without timber harvests, natural fuels will build up, increasing the risk and severity of fire. The reduced vigor of the trees would also increase the risk of insects and disease which could spread to adjacent lands.

Dispersed, Roaded

There would be no significant implications. Timber would be available for harvesting.

Developed Recreation

Visual quality would be improved. The timber resource would be actively managed to enhance the recreation experience creating large trees, open and healthy stands, and emphasizing old growth to create a pleasing environment.

Range

Rangeland would not be significantly affected in any alternative by recreation.

Wilderness and Roadless Areas

In Alternatives which retain areas as roadless, dispersed recreation areas could reduce the number of users in existing Wilderness. Unroaded recreation areas adjacent to Wilderness will mitigate the sights and sounds of development on Wilderness users. This may reduce the need to limit the number of Wilderness users through administrative closures and Wilderness reservations. Most undeveloped recreation areas, however, are currently not as popular as existing Wilderness so these effects may actually be minimal.

Scenic Quality

In the long term, scenic quality will be maintained in recreation related areas. Developed sites such as campgrounds, ski areas, etc., may cause localized decreases in scenic quality. Construction activities at developed sites may cause some short-term decrease in scenic quality.

Wildlife

In the long term, unroaded recreation areas would benefit those wildlife species requiring natural old-growth habitats but would reduce available habitat for species associated with early-stage vegetation. Wildlife species associated with old growth forests and tree snags, such as the northern three toed woodpecker, pine marten, and goshawks, would benefit from the unroaded recreation areas.

Areas managed for primitive and semiprimitive recreation provide suitable habitat for wildlife species not adaptable to roaded or developed areas.

An increase in motorized recreation in developed and dispersed recreation areas would disturb and temporarily displace some wildlife species.

Old Growth

Concentrations of people in developed recreation areas could damage or destroy old-growth forest by destroying understory vegetation and displacing wildlife species.

Social and Economic

Recreation and its related service sectors are becoming an increasingly important component of the Central Oregon economy and way of life to the extent that an alternative accommodates the increasing demands for a diverse spectrum of recreation opportunities. This aspect of the Central Oregon lifestyles will remain stable and growing. Over the long term, the service sectors of the economy which facilitate and accommodate forest based recreationists will comprise a larger share of the local economic, jobs, income and tax base. Retention of the natural landscape in and around the recreation sites would limit timber harvest, mineral activities, and other developments. Recreation sites are usually so small that the overall effect would be minor. Timber managed to meet recreation objectives is more costly than managing for timber production.

An indirect effect of recreation construction would be that employment would increase and materials and supplies would be purchased. Either Forest Service employees or private contractors would be needed to maintain and manage new sites.

As recreation increases, the risk of person-caused fires would increase. The potential damage would be greatest in the unroaded areas where there are large accumulations of natural fuels and fires are difficult to suppress due to limited access.

Areas providing a high degree of solitude, remoteness, natural integrity, and opportunities for primitive experiences and unconfined recreation would be preserved if maintained as roadless, dispersed recreation areas.

Economic benefits associated with the management, harvest, manufacture, and retail sale of lumber products would be foregone in unroaded recreation areas, and to a lesser extent, in developed recreation, winter recreation, and scenic areas.

Areas managed for developed and unroaded recreation and scenic quality would reduce opportunities for geothermal development.

Without roads, people physically unable to negotiate distances or terrain would be excluded from a portion of the National Forest.

Scenic Quality

General Activities

The objective of managing for visual quality is to protect the scenic quality of uncommon or outstanding landscapes. Where visual quality objectives (VQO's) are restrictive, they limit the latitude of activities that can be conducted within these areas.

Consequences on Alternatives

Scenic quality is managed differently in various alternatives. In Alternative C, only the major highways and buttes would be managed for visual quality. Views of human activity, primarily logging, would dominate the landscape. Logging areas and roads would be visible from viewpoints and recreation sites. Due to the accelerated treatment of mature lodgepole pine, some large clearcuts would be visible.

Alternative D emphasizes visual quality. Views of human activities would not be evident from roads and recreation areas because logging would be screened by trees. Important roads, trails, and buttes would be managed to protect or enhance their visual qualities, except where mature lodgepole pine occurs. Treatment of the lodgepole pine would be noticeable because stumps and slash piles would be visible over the short term.

Alternatives F, B (RPA), and E (Pref.) provide different levels of emphasis on visual quality but the majority of the roads, buttes, and recreation areas would be managed to protect or enhance visual quality. Treatment of lodgepole pine would be evident over the short term along major roads and in some recreation areas. Stumps and small amounts of logging slash would be visible until new trees grow. Alternative G protects most roads and trails to enhance visual quality. Treatment of the lodgepole pine would be less noticeable since treatment would extend over a 30-year period.

Alternative H protects or enhances the important visual areas on the west side of the Forest. Visual impacts from treating lodgepole pine would not be as harsh as in the other Alternatives, because treatment would extend over 30 years. See Table IV-9.

Consequences on Resources

Timber

Where VQO's are restrictive, they limit the latitude of timber management activities. In these circumstances, timber volumes may be reduced from levels that might otherwise be achieved. The cost of producing timber in these areas may also be increased due to more complicated logging systems and cleanup procedures.

Range

There will be no significant impacts on the range resource.

Wilderness and Roadless Areas

All designated Wildernesses are managed for a "Preservation" visual quality standard, so there will be no impacts on these areas.

The impacts on roadless areas will relate directly to the number of those areas that are retained in roadless classification or released for some other management activity. Managing some of the roadless areas to meet the visual quality objectives will result in their being roaded, and therefore reducing or eliminating the Wilderness values associated with them. See Table II-3d for a breakdown of acres by roadless areas.

Recreation

Developed recreation areas generally have restrictive VQO's that guide all construction activities. This may increase the cost of some construction items

Table IV-9 Retention and Partial Retention Visual Quality (in Percent)

	Alternatives							
	(CD) A	(RPA) B	C	D	(Pref.) E	F	G	H
Retention	14	10	2	7	8	10	15	14
Partial Retention	11	13	11	15	13	12	11	11
TOTAL	**25**	**23**	**13**	**22**	**21**	**22**	**26**	**25**

such as ski lifts, resorts, and lodges. It could significantly increase the cost of nonconforming uses such as electronic sites. In some cases the visual constraints would eliminate certain types of construction.

In dispersed recreation areas, the visual restriction would be similar, to the developed recreation areas but they would be less restrictive.

Wildlife

There would not be any significant impacts on the wildlife resource.

Old Growth

Areas with VQO's of Preservation, Retention, and Partial Retention would tend to perpetuate old growth.

Social and Economic

Visual management will protect the scenic quality of uncommon or outstanding landscapes for the long term.

Indirect effects may be a greater amount of driving for pleasure to view landscapes. It may also continue to emphasize the importance of the Deschutes National Forest as a recreation Forest.

Another indirect effect may be less economic activitiy related to timber harvesting and processing.

Wilderness

General Activities

Activities include planning, public education, administration, and management to protect the natural conditions, maintain trails and signs, and remove garbage and litter.

Consequences to Alternatives

Because Wilderness is specifically designated by Congress, the number of acres remains the same in all Alternatives.

Consequences on Resources

Wilderness

Natural soil, hydrologic, and atmospheric conditions prevailing within the area would be maintained.

Evidence of human influence and activities in Wilderness would diminish rather than increase over time. The naturalness, uniqueness, and representative ecosystems would be maintained. Educational opportunities for scientific study of natural ecological processes would also increase.

Natural and prescribed fire could be used to maintain Wilderness plant community succession.

Growth of insect or disease populations within Wilderness may spread to adjacent lands.

Timber

No timber harvest is permitted in Wilderness.

Range

Wilderness limits commercial livestock grazing to two allotments permitted prior to establishment of Wilderness. No alternatives would increase commercial grazing within Wilderness.

Localized areas (usually lakes, meadows, and streams) may receive minor damage due to recreation stock.

Recreation

Wilderness provides opportunities for solitude, remoteness, primitive experiences, challenge, and unconfined recreation in a natural environment. If the number of users exceeds the capacity of a Wilderness to provide these primitive experiences, the effects would be mitigated by limiting when and how many people use the Wilderness.

Scenic Quality

An indirect benefit of Wilderness management would be high levels of pleasing scenery.

Wildlife

Animal species associated with high elevation, mature and old growth forests will benefit; but habitat available for those species requiring early-stage vegetation will be reduced. Areas managed for Wilderness would eventually reach the climax plant succession stage except when interrupted by fire.

Old Growth

Wilderness would provide a large resource of old growth.

Social and Economic

In Wilderness, spiritual and therapeutic values will improve for those who seek escape, solitude, remoteness, and individual adjustment. Vicarious enjoyment will be greater for those who find security in the knowledge that Wilderness exists and is preserved for future generations. Options for future generations to manage Wilderness would remain open in areas retained as Wilderness.

Most of the Wilderness areas are probably yielding their highest social and economic value as such. However, there are areas within the Wilderness which could provide higher dollar returns to the local, regional, and national economies if they were to be managed for the development of their commodity resources such as timber and geothermal energy.

Wildlife

General Activities

General activities include prescribed burning and management of trees and other vegetation to provide for wildlife habitat needs and fish habitat improvement.

Consequences on Alternatives

The effects of the Alternatives on big game habitat could determine the long-term population levels for deer. Current Direction (Alternative A) provides for 20,300 deer. Alternatives B (RPA), C, E (Pref.), and F could increase mule deer populations, while Alternative D would provide habitat to maintain populations near current levels. Alternatives G and H would reduce deer populations below current levels. The population predictions are based on the amount of transition and winter ranges on which optimum habitat conditions are provided.

Thermal cover, which is provided by dense stands of trees, would improve in Alternatives C, D, E (Pref.) and F in the long term on winter and transition ranges but would not under Current Direction (A) or in Alternatives G and H. The relationship of thermal cover and feeding areas would be optimized in Alternatives B (RPA), C, D, E (Pref.), and F, but not in Alternatives G and H. Feeding areas would be improved in the short and long term in Alternatives B (RPA), C, D, E (Pref.), and F by burning the older shrubs and replacing them with grasses and forbs.

Table IV-10 shows the potential long-term deer populations, based on the amount and condition of habitat provided by the Alternatives.

Osprey habitat falls into two basic categories: (1) good habitat which is nest trees located within ¼ mile of water and (2) marginal habitat which is nest trees located from ¼ to 5 miles from water. Under Current Direction (Alternative A) both good and marginal habitats are being protected. This is resulting in a gradual increase in osprey numbers on the Forest. Some of the good nesting habitat is disappearing, however, due to the natural loss of nesting sites at Crane Prairie Reservoir. Installation of artificial nest structures could mitigate this. Alternatives B (RPA), C, E (Pref.), and F do not protect the marginal nesting habitat, so osprey populations could be expected to decline in the long term. Alternatives D, G, and H do protect both marginal and good habitat, so osprey populations could be expected to continue to increase. Table IV-11 shows the estimated osprey population levels for each Alternative.

Pine marten habitat to a large degree will decline in the short term in all Alternatives. They occupy mature lodgepole pine which is being reduced because of the mountain pine beetle epidemic. This habitat will be lost whether or not lodgepole pine is salvaged. Alternatives C and D would reduce habitat, in the long-term, to the bare minimum for retaining viable populations of pine martens. Alternatives A (Cur.Dir.), B (RPA), and E (Pref.) would have long term reductions in habitat; while Alternatives G and H would retain marten populations near current levels over the long term.

See the discussion of threatened and endangered species.

Consequences on Resources

Wildlife

There are no significant or direct consequences of managing habitat for one wildlife species on another species. Some indirect effects are that, as habitat is provided for one species, it will result in suitable habitat for other species.

Timber

Mitigation measures would be taken to reduce the effect of localized deer and rodent damage or destruction of tree plantations. This results in higher

Table IV-10 Potential Long-term Deer Populations

	Alternative							
	(CD) A	(RPA) B	C	D	(Pref.) E	F	G	H
Deer Pop.	20,300	28,600	32,300	29,800	25,900	27,100	16,700	13,300

Table IV-11 Estimated Osprey Populations (in pairs)

	Alternative							
	(CD) A	(RPA) B	C	D	(Pref.) E	F	G	H
Pairs of Osprey	180	80	80	150	80	80	180	180

timber management costs with regard to reforestation and animal damage mitigation. Repellents and poisons could be used to control or reduce damage, consistent with the Regional Vegetation Management EIS. Gophers are poisoned and normally die underground limiting the chances of secondary effects on the food chain. In addition to the use of pesticides, physical mitigation measures include fencing and protecting seedlings by caging them in tubes. Some animals other than gophers could also be poisoned. Local research indicates this kind of activity is not a significant problem.[a]

Where vegetation is managed to provide habitat for Northern Spotted Owls, Bald Eagles, and cavity dwelling species, timber yields are reduced below full potential.

In the deer winter and transition ranges, timbered stands are managed to provide thermal cover and are relatively closely spaced when stocked. Because of this, stands are placed in moderate risk prior to commercial thinning and final harvest.

Range

Big game can reduce forage available for domestic livestock. However, this is not a significant consequence.

Wilderness/Roadless

Fish stocking can affect human distribution and use levels in Wilderness and roadless areas. Use levels need to be monitored to prevent damage. Fish stocking would be coordinated with the Oregon Department of Fish and Wildlife to mitigate problems if they occur.

Recreation

Viewing, photographing, hunting wildlife, and fishing also are key activities which attract people to the Forest. A secondary effect of wildlife related recreation activities is increased littering and potential risk of person-caused fires.

Scenic Quality

Prescribed burning for wildlife habitat may have a short-term, adverse impact on visual quality. In the long run, wildlife management programs will generally benefit scenic quality.

Old Growth

An indirect effect of managing vegetation for certain wildlife species (i.e., eagles, spotted owls) habitat is the maintenance and enhancement of old-growth forest characteristics.

Social and Economic

Both consumptive and nonconsumptive uses of the wildlife resources on the Forest significantly contribute to the local economy and are a key element in the lifestyles of many people living in Central Oregon as well as other Oregonians.

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[a] Anthony, Michael R., Zoologist, Hazards to Ground Squirrels and Other Select Species of Wildlife from Strychnine Baiting for Pocket Gophers, PNW 81-115, March 1983.

Geothermal

General Activities

Exploration and development is carried out largely by private companies under the Federal leasing program. The type of activities that are involved in exploring for and developing the resource are shown in Table IV-12.

Table IV-12 Types of Activities Involved in Geothermal Exploration and Development

Process Steps	Activity
Leasing	Environmental analysis and lease recommendations.
Preliminary Exploration	Geologic mapping, electronic surveys, temperature gradient drilling.
Exploration Drilling	Road and drill pad construction, drilling test wells, flow testing wells, abandoning (closing) unsuccessful wells, and rehabilitating disturbed areas.
Field Development	Road and drill pad construction, drilling several wells, flow testing wells.
Plant Construction and Production	Further road and drill pad construction drilling additional wells, constructing generating plant, pipelines and powerlines, and revegetating disturbed areas.
Reclamation	Remove buildings, pipelines etc., abandon (close) wells, and revegetate for other resource use.

Although potential for the geothermal resource appears high, there is a large amount of uncertainty and speculation in the exploration process. Exploration of any particular block of leases proceeds a step at a time and only enters the next step if the results are positive and justify additional expenditure for further exploration. Experience indicates that only a small percentage of the leases are drilled and an even smaller percentage make a discovery and are developed. Activity on the bulk of the leases will not proceed beyond the preliminary exploration stage.

Consequences on Alternatives

The opportunity to explore for and develop the resource is a function of the amount of area and the quality of the resource potential available for leasing. In this respect the alternatives differ in the amount and quality of areas available for leasing. Table IV-13 compares the amount of acres available for leasing by the resource potential classification for each alternative. Most attention should be given to the high and medium categories of resource potential.

Consequences on Resources

Chapter III and the brief summary of activities above give a perspective of how the geothermal resource might be developed. They illustrate some typical developments in terms of the number of wells, plant size, land occupied, etc. How much exploration and development could affect other resources depends a great deal on the location and the character of the resource. Since the location and character of the resource are relatively unknown, the consequences must be viewed in a broad generic way and be based on experiences in other parts of the Country (mainly California) and world. The type of facility will also have a bearing on the type of consequences we could expect. Some assumptions that underlie the discussion are as follows:

1. During the period of the Forest Plan, most of the activities undertaken will be in the exploration category.
2. Based on Regional energy forecasts, if a resource is discovered, it is unlikely that large scale development would occur during the planning period.
3. Technology associated with use of this resource will continue to develop.
4. Primary consideration is given to the consequences of developing the resource to produce electricity, because there are fewer impacts from direct use due to the lesser density of development and some possibility of off-site use.

TABLE IV-13 Acres Available for Geothermal Leasing

Potential	Alternative							
	(CD)A	(RPA)B	C	D	(Pref)E	F	G	H
High	85,900	91,500	126,100	105,000	100,000	80,300	52,800	62,800
Med.	484,000	461,000	486,500	483,100	468,800	461,000	436,300	444,200
Low	402,000	400,100	410,000	410,000	400,100	402,800	399,400	400,000
Unknown	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
TOTAL	944,900	952,600	1022,500	998,100	968,900	944,100	888,500	907,000

5. Lease denial and No Surface Occupancy stipulations will be used as a means of protecting other resources, as defined in the accompanying Forest Plan.[9]

Timber

Under all Alternatives, construction of drill pads, pipelines, roads, generating plants and powerlines would destroy some vegetation. At least a part of the area potentially developable is in timber stands. The resource would be used for 30 years or more during which time the timber resource will be out of production. Areas occupied by buildings, drill pads, and roads will lose all vegetation. Other areas such as pipeline and powerline rights of way and road rights of way, except the running surface, are expected to retain a grass and shrub cover.

The amount of land where vegetation will be lost varies with the type of generating facility. For example, well head generators and small plants (5 to 10 Megawatt) have different requirements for space than do large centralized plants (50 to 100+ Megawatt). Typically centralized plants and related developments occupy from 5 to 20 percent of the surface area of the geothermal field. Field size could vary from 100 acres to several thousand acres. If, for example, one assumes that there is potential to produce electrical energy in amounts ranging from 500 to 10,000 MW (equivalent to the production of from ½ to 10 Bonneville Dams), the amount of surface area affected by development could range from 750 to 15,000 acres. These acres would not be contiguous. The timber resource would be removed from all the area for the range of acres above. With the geothermal resource, the area would be rehabilitated including revegetation with appropriate species.

Range

Grass and shrub cover would remain or be reestablished on about 25 to 50 percent of the area during the period electricity was being produced. Disturbed soil would be revegetated concurrent with development; and when the geothermal resource would be depleted, the remaining area would be rehabilitated including revegetating the appropriate species. There are no significant effects on range because most potential geothermal areas are not in range areas. Some minor amounts of forage would be created in pipeline and powerline right of ways.

Wilderness and Roadless

Classified Wilderness was withdrawn from mineral entry and leasing on January 1, 1984. The Oregon Cascades Recreation Area (OCRA) prohibits leasing after January 1, 1989. In keeping with the above, no leasing is planned in Wilderness or the OCRA.

Development of the geothermal resource could have some indirect effect on Wilderness or the OCRA, if the resource were to be developed with generating plants located directly adjacent to these areas. Visual quality could be indirectly affected in these areas due to steam plumes and visibility of some structures if development occurs. Noise during well drilling, well testing, plant construction, and odors from hydrogen sulfide are other possible indirect effects. There are muffler systems that are used to mitigate noise, scrubbers to remove most of the hydrogen sulfide odors, and some generating systems that utilize technology that does not create a steam plume from cooling towers.

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[9] Other resources can be protected from the effects of exploration and development by denying leasing in those areas. Another level of protection can be obtained by using leasing stipulations. For example, a "No Surface Occupancy" stipulation can apply to a lease or portion of a lease to control surface use. There are several varying levels of protection under the general term "No Surface Occupancy", depending on the specific wording of the stipulation. Different levels: 1) allow no surface use, 2) allow limited use of the surface for exploration purposes only, and 3) prohibit plant siting on the surface. The use of this type of stipulation provides resource protection yet allows a leasee to keep the area under the control of its lease even though use is restricted.

Exploration and development of the geothermal resource could also affect roadless areas. The extent to which geothermal and other resource management activities could potentially affect roadless areas can be determined by viewing Appendix C and Table II-3d. These references show the acreages involved with different management strategies. Strategies which favor timber production and winter recreation/ geothermal are generally compatible with geothermal exploration and development, so could affect the roadless character by creating roads. During the exploration phase some road construction may be required and, although the density of these roads would not likely be high, they would be higher than what currently exists. In current roadless areas, it may be possible to use low density roads developed for winter recreation for exploration or the reciprocal, using the roads developed for exploration for winter recreation purposes. If a resource were discovered and developed, road density would increase. Roadless areas could also be affected indirectly by noise, odors, and visuals from activities on adjacent areas.

Recreation

Dispersed Recreation

Unroaded. In areas where the management strategy is to provide dispersed recreation with an unroaded character, there will be no direct effects in any alternative because leasing is denied. The indirect effects would be noise, odors, and possible views of adjacent development.

Roaded. Geothermal exploration and development may add to the road system and create additional opportunities for dispersed recreation such as sightseeing, hunting, cross-country skiing, etc.

Developed Recreation

There would be no direct effects because leasing would be denied or limited through a No Surface Occupancy stipulation.[10]

Leasing would be denied in developed sites such as campgrounds, ski areas, day use areas, etc. The remaining portion of the area would permit only limited use of the surface for low-impacting exploration activities. One effect of this protection would be to prohibit ski areas and resorts from utilizing the resource in their immediate area, even for direct use, since a lease must be authorized to provide for any type of geothermal resource use.

Developed recreation may be indirectly affected by noise, odors, and by the sights of adjacent activity and development.

Visual Quality

Construction of roads, drill pads, and plant development may affect the visual quality. These effects may not be pronounced during the exploration phase. However, if the resource is developed, some of the facilities would be visible. Plant siting in highly sensitive areas where the strategy is to manage for the visual resource such as along major highways, would not be permitted. Depending on the powerplant technology used, some steam plumes from cooling towers could be visible. In the operating stage, there would be an industralized character to the sites. While proposals for development will be expected to meet visual standards, there may need to be a few exceptions because many of the visual areas are linear in shape and must occasionally be crossed. Some mitigation of visual impact is possible by controlling the pattern of vegetation removal and the design and color of facilities.

Wildlife Habitat

Human activity associated with exploration and development may affect wildlife habitat use patterns on an intermittent basis. Exploration activities are generally low density and short term, ranging from a few days to a few months. If development takes place, activity would be substantially increased during construction and development, but would ultimately reduce to a lower level during production. The production phase would last for 30 or more years.

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[10] Another form of the No Surface Occupancy stipulation which provides for use of the surface for limited types of exploration. Surface use for production and development are not permitted.

The timing and location of the activities in relation to key habitat and use patterns would determine the significance of displacement or disturbance. Potential conflicts would be greatest in areas where wildlife concentrate and during periods such as migration and reproduction.

Stipulations that restrict the season of use will be used to mitigate the effects and protect sensitive wildlife habitat.

Threatened and Endangered species habitat will be protected by limiting surface occupancy.

Old Growth

The old growth resource should not be significantly affected by geothermal exploration and development. This is because the acreage affected by activities will be small and dispersed.

Other Environmental Consequences[11]

There are several other resources that could be significantly affected by geothermal development. An accurate assessment of the potential consequences must await a time when information is known about the character of the resource and the technology being proposed for its development. Therefore, the following discussion treats in a generic way some consequences experienced in developing the geothermal resource in other locations.

Air. Impacts of a single geothermal facility on air quality are usually minimal, when viewed from a Regional or National basis; however, they may be locally significant because of highly site specific factors. The complex geochemistry of geothermal fluids is exemplified by variations in concentrations of noncondensible gasses from field to field and even from well to well.

Noncondensible gasses are typically carbon dioxide with lesser amounts of ammonia, methane, hydrogen sulfide, mercury, radon, boron, and trace metals.

Noncondensible gasses are principally emitted by condenser gas ejection, cooling tower exhaust, power plant bypassing during shutdown, and well venting. Hydrogen sulfide is the most troublesome of the gasses because of its odor, even at low concentrations. At higher concentrations it affects the nervous system by causing excitement and dizziness. Systemic hydrogen sulfide poisoning can result in respiratory failure.

The greatest danger is to drilling crews during drilling. Available mitigation measures would include detection and alarms, emergency breathing equipment, well shutdown procedures, mufflers with scrubbers, and chemical solutions that can be injected to remove hydrogen sulfide.

Concentrations causing discomfort but not posing a risk to public health or welfare occur at generating facilities. Several treatment technologies have been developed for generating plants, including those that create sludge as a waste product and need proper disposal. Present evidence indicates that hydrogen sulfide will not cause severe vegetation damage. Various State and Federal agencies are proposing emission limits for hydrogen sulfide.

Boron has been determined to cause symptoms of stress and serious damage in some tree species. It is unclear whether it would be considered a serious environmental hazard at this time. There are ways to mitigate its effects by removing it.

Noncondensible gasses appear to be a minor problem when resource development uses binary generating technology or is a direct use. This is because the technology used a closed system to handle the geothermal fluids, thereby reducing their exposure to the atmosphere.

Water. Water pollution could occur at any stage of geothermal exploration or development. Many regulations and operating orders are intended to prevent contamination. Surface or ground water can be affected by drilling mud which may contain petroleum based additives; by potential blowouts, in which a well casing ruptures and geothermal fluids mix with water; by rock cuttings that contain toxic chemicals; and by surface erosion during construction. Most of these conditions can be prevented by isolating the surface or ground water from the possible contaminants. This is done by using impermeable lined sumps, properly designed wells and casing, and removal of toxic wastes to acceptable disposal sites.

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[11] Further detail can be found in a June 1985 publication by Bonneville Power Administration, Volumes I and II, "Evaluation and Ranking of Geothermal Resources for Electrical Generation or Electrical Offset in Idaho, Montana, Oregon, and Washington," by R. G. Bloomquist, G.L. Black, D.S. Parker, A. Sifford, S.J. Simpson, and L.V. Street.

The most serious potential contaminant is "spent" hydrothermal fluids. There are several potential ways of disposing of the fluids including evaporation, surface spreading, and injection. The method depends upon the quantity of waste water. Injection into the producing aquifer is the preferred method especially when fluids contain brine (salts) and other potential pollutants. In addition to disposing of the potential pollutant, this method has the advantage of helping to maintain the long-term productivity of the field because fluid is often the limiting resource in the transfer of heat to the surface. Subsurface disposal is regulated by the Environmental Protection Agency Regulations, and by State programs developed under the Safe Drinking Water Act.

Direct geothermal applications generally contain much lower levels of dissolved compounds and the fluids are frequently disposed of at the surface after cooling.

Noise. A number of significant noise sources are associated with development and utilization of the resource. These sources include sounds from large, diesel powered engines used in construction machinery, compressors and well drilling equipment, compressed air releases, turbines, gas ejection, cooling towers, and venting of geothermal steam during well testing and plant shutdowns. For example, the noise level from venting an unmuffled well could reach 130 decibles (dB) (about the level of a jet on takeoff). The noise levels for drilling could reach 90 dB, and a cooling tower for a 100 MW plant could reach 84 dB (slightly higher than a busy street corner in a city). If sensitive receptors such as schools, residences, or recreation areas are located closer than one mile, there is likely to be some annoyance or complaints unless additional mitigation steps are taken. Preliminary noise studies from The Geysers on wildife indicate that moderately increased sound pressure levels up to 100 dB do not produce any drastic changes in wildlife communities. There is some evidence that certain species are displaced from noisy areas but no proof that noise is the casual factor[12].

Noise shielding by terrain, vegetation, and equipment can mitigate noise level. Full use of demonstrated noise control technology can reduce most source noise to levels acceptable to most quiet rural communities at a distance of 1,000 feet[13].

Noise levels are generally insignificant at direct use geothermal sites.

Induced Seismicity. Many of the world's hydrothermal reservoirs are located in regions with a high frequency of naturally occurring seismic events. A potentially significant environmental issue is whether the withdrawal or injection of geothermal fluids may raise the rate of microseismic events or trigger a major earth movement.

On the Deschutes National Forest it seems unlikely that induced seismicity would be a potential problem for two reasons: (1) the portion of the Cascades located on the Forest exhibits a very low level of seismic activity and, (2) experience with fluid injection in a number of non-geothermal situations has demonstrated that induced seismicity can be minimized or prevented by regulating injection pressures.[14] The Federal Energy Regulatory Commission concluded that "it is extremely unlikely that major seismic events could be triggered in this way".[15]

Land Subsidence. The removal of large amounts of geothermal fluids from a geologic formation may cause land surface subsidence (sinking). Permanent and non-recoverable subsidence results from long-term removal of fluids and from the compression of aquitards such as clay, silty material or shale above and below a reservoir.

Subsidence problems can be mitigated through injection of spent geothermal fluids (or other sources of water) which serve to maintain pressures within the reservoir.[16,17,18] However, even with mitigation there could still be some localized sinking around withdrawal wells and some uplifting around injection wells.

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[12] Leitner, P. "An Environmental Overview of Geothermal Development at the Geysers - Calastoga KGRA", Vol. III, "Noise", and Vol. V, "Ecosystems Quality", Lawrence Livermore Labs, Livermore California, 1978.

[13] Norris, Thomas R. Environmental Noise Need not Hinder Geothermal Power Development: Geothermal Resource Council Transactions. Vol. 6, pp. 509-512, 1982.

[14] O'Banion, K. and Layton, D. District Use of Hydrothermal Energy: Review of Environmental Aspects. Lawrence Livermore Labs., Livermore, California, 1981.

[15] FERC, Rulemaking for Small Power Production and Cogeneration Facilities—Eruption for Geothermal Facilities. Western Regional Final Supplemental EIS Docket No. RM 81-2. 1981

[16] FERC, 1981

[17] O'Banion and Layton, 1981.

[18] Webb, J.W.; Eddleman, G.K.; Reed, A.W., Retrospective Examination of Geothermal Environmental Assessment: Oak Ridge National Lab., Oak Ridge, Tennessee, ORNL/TM-9071.

Reinjection of spent geothermal fluids from electrical generation is the usual practice in the United States and serves to conserve the resource and serves as a preferred disposal method for the fluid. Because of the rolling topography on the Forest, it is unlikely that subsidence would be a significant problem.

Water Supply. Geothermal power production typically requires large amounts of water for cooling by evaporation. The source of this water is usually the condensed steam from turbines. At The Geysers in California, for example, about 80 percent of the condensed water from turbines is sent to cooling towers where it evaporates, thereby cooling the system. The remaining 20 percent is injected back into the geothermal reservoir.

Binary systems (in which all geothermal fluids are reinjected) can require large volumes of water for cooling from sources other than geothermal reservoirs. These sources could be lakes, rivers, and ground water. If evaporation were used to cool a 50 megawatt plant, hundreds to thousands of gallons per minute would be needed. Water from a lake, river, or an aquifer would be evaporated and added to the atmosphere. Alternatively, surface or ground water could be used to cool a power plant. Then it would be returned to its source. The returned water would have been heated so that the temperature of the lake, river, or aquifer from which it came would be warmed to some extent. The amount of water needed, even though it would be returned, would be substantially greater than that needed for evaporative cooling.

Surface waters above Bend, Oregon, have been withdrawn from future appropriations. However, in rare instances it may be possible to use some of these waters for geothermal cooling. It is generally believed that the ground water basins on the Deschutes National Forest hold a substantial supply of water, except for an area in Lake County which is associated with agricultural irrigation near Christmas Valley.[19] A geothermal project proposing to use ground water would need to obtain water rights through the State of Oregon and demonstrate non-degrading effects on the ground water supply.

In summary, development of the geothermal resource for power production has the potential to be a substantial user of the ground water resource. However, until the type of resource and its reservoir characteristics are understood and the plant technology is determined, it is difficult to determine the effects on ground water. It should be possible to limit or mitigate the impacts because geothermal is developed in increments and need not move to the next increment unless the effects on groundwater are acceptable.

Social and Economic. Social effects may be caused by some influx of new residents into the area. Chapter III (Economics of Geothermal Development and Operation) estimates the number of workers at 50 per day for about 24 months and recognizes the possibility that some 600 different individuals might be involved during the construction of a 50 megawatt plant. If you assume 3.5 family members per worker, this could put some 175 people in the area temporarily because of the project. Similarly the operations and maintenance workforce of 10 to 20 workers would involve 35 to 70 people living in the area on a permanent basis.

Assuming that 50 percent of these people come from outside the local area, such an increase would probably not affect a city the size of Bend; however, such an increase could be significant to the smaller outlying towns in the area. Such population increases may require the development of additional housing and public services, including schools. Similar impacts have been mitigated elsewhere by using contributions from the geothermal developers on a "cost-incurred" basis for the increased public service requirements. Another source of funds to mitigate the impact is provided by Public Law 94-579 Section 317(c) which allows counties to borrow funds from the Federal Government against future revenues which they will receive from rentals and royalty payments made by the developers.

Depending on the scale of geothermal development, the generating plant will tend to give visitors to the Forest the impression of a low density industrial development of a type they are more accustomed to seeing near urban areas. Such an impression can be minimized by proper design, coloration, vegetation managemet and other methods. Nevertheless the installation will change the character of the Forest because of its relatively permanent nature. A geothermal development could attract a significant number of visitors interested in understanding its operation and the resource being utilized.

Economic impacts of geothermal development consist of effects on employment and income to individuals. These effects are created by temporarily employing people for drilling and plant construction and permanently employing people for operating and maintaining the development. For example, a Federal Energy Commission report estimates that the construction of a 100 megawatt plant would create 15 permanent jobs and 150 to 175 temporary jobs. On the basis of $20,000 annual wages per worker and an employment multiplier of 2, each 100 megawatt plant should result in a net income increase to the area of approximately $7,000,000.[20]

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[19] OAR 690-10-050, 3/26/84.

There is also the potential for significant revenues to the county or counties involved based on their sharing 50 percent of the rent and royalty payments from Federal land. Additionally the value of the developments would contribute to the area's property tax base.

Probable Adverse Environmental Impacts that Cannot Be Avoided

1. Soil would be displaced as a result of timber sales, slash treatment, and construction of roads, trails, and recreation facilities. Overall, soil productivity would be maintained except for sites dedicated to roads, landings, recreation sites, and other facilities or uses which compact the soil or occupy a site.
2. Air quality may be temporarily degraded in localized areas as a result of prescribed fires.
3. Short-term degradation of visual quality in recreation and visual areas would occur as a result of harvesting mountain pine beetle infested lodgepole pine.
4. Areas suitable for undeveloped recreation (ROS categories of Semiprimitive Nonmotorized, or Semiprimitive Motorized) could become unsuitable for this type of recreation experience if they are allocated to other land uses. Management prescriptions (practices) scheduled for these other land uses could permanently destroy or temporarily modify attributes making them suitable for undeveloped recreation (i.e., building roads; changing land form; or changing vegetation arrangement, species composition, or age class mix).

Irreversible or Irretrievable Commitment of Resources

Acres committed to facilities and roads constitute an irretrievable loss of vegetative production. Land committed to major roads and facilities could be considered to be an irreversible effect.

Roadless areas committed to development, once developed, would no longer be suitable to Wilderness classification.

Use of mineral resources such as cinders and gravel has both irretrievable and irreversible effects.

Short-Term Use and Long-Term Productivity

In the long term, development of geothermal resources may be irretrievable because the heat source would be exhausted.

The most significant activity proposed by the Alternatives is the management of vegetation for timber production, wildlife habitat, recreation and visual resources. Livestock grazing also affects the vegetation. The short-term effects increase the long-term productivity as existing conditions are altered to enhance the long-term conditions. Replacing existing slow or stagnated stands of trees with younger stands increases long-term production. Replacing decadent stands of bitterbrush and sage brush with younger stands or grasses and forbs increases the long-term production of mule deer habitat. Short-term use of soils for roads, landings, or other activities which compact soil will reduce the long-term productivity on a site specific basis. This would occur on a small portion of the Forest and would be widely scattered.

Coordination With Local, County, State, and Federal Governments

Coordination with other agencies occurred throughout the planning process. The major local, County, State, and Federal agencies contacted include the City of Bend; Deschutes and Jefferson Counties; the Confederated Tribes of the Warm Springs Reservation; Oregon Department of Fish and Wildlife; Oregon Department of Forestry Fish; and Wildlife Service, Endangered Species Branch, U.S. Department of the Interior; and the Bureau of Land Management. The Preferred Alternative does not conflict with objectives of the aforementioned agencies with the exception of the State's Forestry Program for Oregon. Alternative C meets their objectives but Alternative E, the Preferred Alternative, is below the wood outputs projected by their plan. See Table IV-14.

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[20] FERC, 1981.

Table IV-14 Comparison of the Preferred Alternative and other Alternatives with Goals of the Forestry Program for Oregon, Oregon Forestry Department

FPFO Basic Objective	Level 1[1]	Level 2[2]	Level 3[3]	Discussion
To maintain community stability by remaining the flexible for increases in future harvest levels that would offset projected shortages. This basic objective has two components. One is that the Deschutes meets or exceeds the FPFO decadal wood output targets and the other is that departures from even-flow sustained yield be considered as a means to do so. Decade — FPFO Target (MMCF/Year) 1 — 43.5 2 — 43.8 3 — 44.9 4 — 46.8 5 — 47.6 10 — 48.7	C	B, E, H	A, D, F, G	To FPFO wood output targets for Deschutes NF start at 43.5 MMCF/year in Decade 1 and gradually climb to 47.6 MMCF/year in Decade 5 and 48.7 MMCF/year by Decade 10. Alternatives B, C, E, and H all deviate from nondeclining yield by accelerating the harvest of surplus old-growth inventory. Alternative C is the only one to meet or exceed all targets. The Preferred Alternative (E) met or exceeded the targets for the first four decades. Alternatives B and H achieved the targets for 3 decades. Alternatives A, D, F, G, were based on nondeclining yield and met the targets 2 or fewer decades.
To maintain the maximum potential commercial Forest land base consistent with other resource uses while assuring environmental quality. There is a concern that standard forest lands are being put to some uses other than the maximum growth and harvest of timber. Land Use Planning must be monitored and coordinated to maintain the standard commercial forest land base of the Current Direction (Alt. A).	A, B, C, D, E, F, G, H			The Forest Planning Regulations (36 CFR 219.14) generally describe which types of lands are suitable commercial forest lands. Based on this process, it was determined that the Deschutes NF had 1,148.7 M acres of tentatively suitable land (Refer to Table III-1). In the Current Direction (Alternative A), 63 percent of the tentative suitable is managed as timber land with no restrictions on timber growing beyond standard environmentmental considerations. In all other alternatives, from 66 percent to 86 percent of the tentatively suitable is managed for timber. Preferred Alternative (E), has 69 percent available for timber.
There is a concern that suitable forested lands in Oregon are not being managed to their fullest potential to produce wood. In order to meet the future demand for wood, more intensive management than is currently being practiced is needed. These intensive management practices include brushfield conversion, release, precommercial thinning, commercial thinning, and fertilization.	A, B, C, D, E, F, H		G	All lands being managed for timber crops in all alternatives had the option of using low, medium, or high intensity silvicultural prescriptions based on economic efficiency criteria. Accordingly, intensive management was not applied to all suitable and available acres. Brusnfield conversion is not a big opportunity on the Deschutes, and fertilization is not used since it has limited beneficial results. Over the next 20 years, the Current Direction (Alternative A) calls for 191 M acres of TSI. The Preferred Alternative (E) calls for 227 M acres of timbershed improvement. All of the other alternatives schedule from 189 to 302 M acres of TSI.

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[1] Level 1: Meets share of FPFO target level and is compatible with basic objective.
[2] Level 2: Is compatible with the basic objective, but does not meet the target level.
[3] Level 3: Does not meet target level and is not compatible with the basic objective.

Energy Requirements and Conservation

Table IV-15 is the estimated net balance for each alternative. The table shows the difference between the estimated energy requirements and the energy outputs for each alternative. The values in the table are all negative which indicates that implementation of any alternative would consume more energy than it would produce. The amount of potential geothermal energy available on the Forest was not considered in the calculations. Given development of the projected potential, the energy output for each alternative could rise significantly. Examples of items which were used to calculate energy input are:

Timber:
Logging, construction and maintenance of roads, transport to mill, processing.

Range:
Forage improvement, structural improvement.

Recreation:
Developed recreation access, dispersed recreation.

Some of the items used to estimate energy output from each alternative are:

Timber:
Firewood

Water:
Potential additional hydropower development at existing facilities.

Table IV-15 Estimated Net Energy Balance By Alternative in Billions of British Thermal Units

Alternative	1986 (Planned)	2000 (Potential)	2030 (Potential)
A (Cur. Dir.)	-1,928.9	-1,447.8	-1,328.6
B (RPA)	-1,767.2	-1,458.7	-1.354.3
C	-2,162.5	-1,439.5	-1,584.0
D	-2,309.3	-1,498.0	-1,567.7
E (Preferred)	-1,788.7	-1,464.0	-1,422.4
F	-1,818.6	-1,448.8	-1,473.8
G	-1,746.6	-1,539.3	-1,402.4
H	-1,708.1	-1,449.1	-1,317.1

LIST OF PREPARERS

Norm Adams

Position:
Forester, Timber Management Planner

Education:
Bachelor of Science in Forest Management, Washington State University, 1964.

Experience:
Assistant Staff in timber for Silviculture, Inventories and Planning, and Timber Management Specialist in Unit Planning on the Siuslaw National Forest. Assistant Ranger and Timber Sale Officer on Wenatchee National Forest. Other temporary assignments in Recreation Planning, Air Operations, Contract Administration, Data Base Management, and Timber Inventory. Forest Interdisciplinary Team and timber inventories on Deschutes National Forest, 2 years.

Bill Anthony

Position:
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Education:
B.S. in Business Adminstration, Pennsylvania State University, 1973.
M.S. in Business Administration, University of Arizona, 1974.
M.S. in Forest Management, Utah State University, 1981. Thesis: An Application of Linear Programming to Forest Recreation Planning: Integrating Facility Development and Timber Harvest Scheduling.

Experience:
1980-Present: Operations Research Analyst on Deschutes Interdisciplinary Planning Team.
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1975-1977: Research Analyst and Management of Program Evaluation for United States Travel Service, Department of Commerce.

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Twenty-three years with the Forest Service, mostly spent in the Pacific Northwest Region (R-6). Short tour in the Chief's Office (Washington D.C.). Worked at most all jobs at the Ranger District level and spent 4 years as District Ranger on Willamette NF. Approximately 12 years on the Rogue River NF, and 4 years on the Mt. Baker NF. Project leader on the Skagit River Wild and Scenic River Study. Involved in Land Management Planning off and on for approximately 6 to 8 years. Planning on Deschutes NF for 2 years.

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Joanna Booser

Position:
Forester

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B.A., Biology, Swarthmore College, Swarthmore, PA, 1972.
Masters in Forestry, Duke University, Durham, North Carolina, 1974.
Certified Silviculturalist, Region 6, 1984

Experience:
Forester, Bend District, Deschutes National Forest; Researcher, Ecosystem Dynamics and Ornithology, South Florida Research Center, Homestead, Florida, National Audubon Research Station, Tavernier, Florida, and Rocky Mountain Biological Laboratory, Gothic Colorado; Forestry Consultant, Guatemala; Forestry Technician, Hoback District, Bridger-Teton National Forest, Wyoming; Ranger-Naturalist, Yellowstone National Park, Wyoming, and Everglades National Park, Florida.

Steve Calish

Position:
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Education:
B.S. Forestry, University of California at Berkeley, 1974.
M.S. Wildland Resource Science, University of California at Berkeley, 1976. Thesis: "The Effect of Nontimber Values on Optimum Timber Rotations."

Publication:
"The Mountain Lands: State and Private Resource." State of Utah Forestry and Fire Control, 1973. (With Dr. Roger Fight and Dr. Dennis Teeguarden) "How Do Nontimber Values Affect Douglas Fir Rotations?" Journal of Forestry, Vol. 76, No. 4, April 1978.

Experience:
Two years as Forest Economist on the Deschutes National Forest Interdisciplinary Team. Presale Forester on the Monte Cristo District, Mt. Baker-Snoqualmie National Forest. Associate and research assistant, Dept. of Forestry and Resource Management, University of California, Berkeley.

Tom Carroll

Position:
Forest Economist

Education:
B.S., Economics, University of Idaho, 1970.
M.S., Agricultural and Resource Economics, 1980.

Experience:
Instructor of Economics, Lewis and Clark College, Portland, Oregon, 1 year. Various research projects, Oregon State University, 2 years. Economist, Central Oregon Intergovernmental Council, 1 year. Instructor of Economics, Central Oregon Community College, Bend, Oregon, 1 year.

Vincent Cegelka

Position:
Forest Planner

Education:
B.S., Forest Management, Pennsylvania State University, 1955.

Experience:
Ranger Districts on Gifford Pinchot and Winema National Forests as Timber Management Assistant, 4 years. Regional Office (R-6) Timber Management, Systems Analyst and Mensuration, 9 years. Washington Office as Systems Analyst, 2 years. Forest Planning, Deschutes National Forest, 6 years.

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M.S. in Geology, Portland State University, 1976

Experience:
Geologist for Deschutes National Forest with principal work in materials and foundation investigations, management of pits and quarries and geothermal resources planning from 1972-1985.

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Eduation:
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Experience:
Worked for cultural resource program, University of Montana, 2 years; cultural resource program, University of Pittsburgh, 3 years; District Archaeologist, Custer and Kootenai National Forests, 3 years; Archaeologist, Montana Department of Natural Resources, 1.5 years; Forest Archaeologist, Deschutes NF, 3 years.

Robert Eidenberger

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Forester, Assistant Planner

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Experience:
Worked in Timber Management on Malheur National Forest, 7 years; Timber Resource Assistant on Sisters District, Deschutes National Forest, 11 years; Deschutes National Forest Interdisciplinary Team for 3 years.

Jim Galaba

Position:
Recreation

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Bachelor of Science in Forestry, University of Maine

Experience:
Held positions in Timber, Fire, Recreation and Special Use Management on several Ranger Districts on the Six Rivers, Inyo, and Angeles National Forests of California. Participated in land use planning on the Inyo and Angeles NF. Involved in recreation management and as a Interdisciplinary Team Member on Planning Team on the Deschutes National Forest, 3 years.

Gary F. Kellogg

Position:
Soil Scientist

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B.A., Architecture, Washington State University, 1970; B.S., Conservation (soils), Washington State University, 1971.

Experience:
Worked on the Detroit District as Civil Engineer Technician. Soil scientist on the San Juan National Forest in Colorado and Shoshone and Bighorn National Forests in Wyoming. Most of the work in soils dealt with forest soil management service and soil survey work. Was a member of the Shoshone NF Interdisciplinary Team for the DuNoir study area. Soil scientist and member of the Deschutes National Forest Interdisciplinary Planning Team, 2 years.

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Experience:
Meterological Technician, Rocky Mountain Forest and Range Experiment Station, 4 years; Forest Hydrologist, Sequoia National Forest for 3 years and served as member of Forest Interdisciplinary Team on preparation of a unit plan. Forest Hydrologist on Deschutes National Forest for 7 years and member of Forest Interdisciplinary Team for 6 years.

Greg McClarren

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Experience:
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Joan McNab

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Editor for General Accounting Office, Washington, D.C., 3 years; Computer Technician, Deschutes National Forest, 2 years; Writer/Editor, Deschutes National Forest Planning Team, 5 years.

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Experience:
Range Conservationist and Wildlife Biologist on San Juan National Forest in Colorado, the Shoshone National Forest in Wyoming, and the Black Hills National Forest in South Dakota and Wyoming. Interdisciplinary team Member on Deschutes National Forest as Wildlife Biologist 3 years, Forest Planner, 4 years.

Ernie Nelson

Position:
Timber Management Assistant

Education:
B.S. Forest Management, University of Minnesota, 1967

Experience:
Timbr management on Siskiyou National Forest, 3 years; timber management 2 years on Deschutes National Forest and 5 years on Wenatchee National Forest; Timber planner 2 years on Deschutes and Ochoco National Forests; and Timber Management Assistant 6 years on Deschutes National Forest.

Bob Parker

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Transportation Planner

Education:
Bachelor of Science in Civil Engineering, University of Tennessee, 1961.

Experience:
Worked with the Kentucky Department of Highways, Division of Planning for 4 years. Forest Service experience has been on the Allegheny National Forest in Pennsylvania, 3 years; Jefferson National Forest in Virginia, 3 years; the Francis Marion and Sumter National Forests in South Carolina, 6 years; and Deschutes National Forest NF Interdisciplinary Team Member, 3 years. Forest Service experience has been in road and facility design and construction. Deschutes National Forest experience primarily has been in transportation planning.

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1980-Present - Recreation Staff Officer, Deschutes National Forest;
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1971-1975 Timber Management Assistant, Mapleton District, Siuslaw National Forest;
1967-1971 Forester, Oakridge District, Willamette National Forest

Steve Sherwood

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Economist

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B.S. Forest Management, Colorado State University, 1977, M.S. Natural Resource Economics, Colorado State University, 1980.

Experience:
Held positions as Research Forester at the Rocky Mountain Forest and Range Experiment Station; Graduate Research Assistant at Colorado State University; Forest Technician Tieton District, Wenatchee NF; and Biological Technician, Rocky Mountain Forest and Range Experiment Station. Planning Team Member, Deschutes National Forest, 4 months.

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Bachelor of Science in Forestry Management, Purdue University, 1953;
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Experience:
1975-Present: Lands and Minerals Staff, Deschutes National Forest.
1970-1975: Land Adjustment and Rights of Way specialist Mt. Baker/Snoqualmie and Snoqualmie National Forests.
1958-1970: A variety of positions in the Timber Management field at the Ranger District level on the Mt. Hood and Snoqualmie National Forests.

Anthony Smith

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25 Years - Timber Management, Deschutes National Forest.

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Position:
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Automotive Mechanics, J.M. Perry Tech., Yakima, Washington

Experience:
Progressive positions on the Umpqua National Forest to suppression crew foreman. Three Fire Management Officer positions on various districts on the Gifford Pinchot National Forest. Forest fire planner for the 1972 National Fire Planning effort, Gifford Pinchot National Forest. Fire and Fuels planner for the Tussock Moth Project, 1974, Walla Walla District, Umatilla National Forest. Instructor at the National Fire planning training session FOCUS) Fort Collins, Colorado, 1980. Trainee, National Fire planning training session, Marana, Arizona. 1981 Fire and Hazard planner, St. Helens volcano disaster plan, 1980. Interdisciplinary Team Member on Deschutes National Forest, 6 years.

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1973 B.S. Biology/Humanities, Lewis & Clark College, Portland, Oregon. M.S. Fire Sciences/Forestry, University of Washington.

Experience:
1968-1971 Willamette National Forest; 1972-1978 U.S. Forest Service smokejumper Redmond, Oregon and LaGrande, Oregon. Interdisciplinary Team Member on Deschutes National Forest, 1 year.

Mike Znerold

Position:
Forest Silviculturist

Education:
1979 M.S. Forest Ecology and Silviculture, Washington State Univ.
1975 B.S. Forest Resource Management, Humboldt State Univ.

Experience:
1983-Present Forest Silviculturist
1981-1983 District Silviculturist, Sisters District, Deschutes National Forest;
1979-1980 District Silviculturist, Sweet Home District, Willamette, National Forest;
1975-1978 Forester, Canyon RD, Clearwater National Forest

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT AND DRAFT FOREST PLAN ARE BEING SENT

Copies of the Draft Environmental Impact Statement (DEIS), maps, Appendices, and Proposed Forest Plan were distributed to the following individuals, organizations, and Government agencies who specifically requested the complete set of documents. The mailing list of people and organizations interested in the planning effort is much larger. Because of the cost of producing and mailing the complete DEIS and Proposed Forest Plan, a shorter "Reviewer's Guide" was prepared. It contains a summary of the DEIS. Those individuals requesting information on the Forest Plan, or who attended prior public meetings, were mailed a "Reviewer's Guide". The distribution list for those receiving the "Reviewer's Guide" is not included in this document due to its considerable length. The list, however, is available for examination at the Forest Supervisor's Office in Bend, Oregon.

Anyone requesting a complete set of documents will be mailed a loaner copy or referred to a local library.

FEDERAL AGENCIES

Advisory Council on Historic Preservation, Washington, D.C.
Agriculture, Department of
  Animal and Plant Health Inspection Service, Hyattsville, MD
  Forest Service, Washington, D.C.
    Regional Offices
    Region 1, Missoula, Montana
    Region 2, Lakewood, Colorado
    Region 3, Albuquerque, New Mexico
    Region 4, Ogden, Utah
    Region 5, San Francisco, California
    Region 6, Portland, Oregon
    Region 8, Atlanta, Georgia
    Region 9, Milwaukee, Wisconsin
    Region 10, Juneau, Alaska
      National Forests
        Region 6
          Colville, Colville, Washington
          Deschutes, Bend, Oregon
          Fremont, Lakeview, Oregon
          Gifford-Pinchot, Vancouver, Washington
          Malheur, John Day, Oregon
          Mt. Baker-Snoqualmie, Seattle, Washington
          Ochoco, Prineville, Oregon
          Okanogan, Okanogan, Washington
          Olympic, Olympia, Washington
          Rogue River, Medford, Oregon
          Siskiyou, Grants Pass, Oregon
          Siuslaw, Corvallis, Oregon
          Umatilla, Pendleton, Oregon
          Umpqua, Roseburg, Oregon
          Wallowa-Whitman, Baker, Oregon

- Wenatchee, Wenatchee, Washington
- Willamette, Eugene, Oregon
- Winema, Klamath Falls, Oregon

- Other National Forests
  - George Washington, Harrisonburg, Virginia
  - Salmon, Salmon, Idaho
  - San Juan, Durango, Colorado
  - Sumter, Columbia, South Carolina
- Silviculture Laboratory, Bend, Oregon
- Pacific Northwest Station, Portland, Oregon, and Corvallis, Oregon
- WESTFORNET - North, Seattle, Washington
- WESTFORNET - South, Berkeley, California

- Agricultural Research Service, Oregon/Washington
- Agricultural Stabilization and Conservation Service, Washington, D.C.
- Office of Equal Opportunity, Washington, D.C.
- Rural Electrification Administration, Washington, D.C.
- Soil Conservation Service, Washington, D.C.
  - State Conservationist, Bend, Oregon
- Commerce, Department of, Washington, D.C.
  - National Marine Fisheries Service, Portland, Oregon
- Defense, Department of
  - Deputy Assistant Secretary of Defense, Washington, D.C.
  - U.S. Air Force, Washington, D.C.
  - Explosives Safety Board, Alexandria, Virginia
  - Army Corps of Engineers, Washington, D.C., Portland, Oregon
  - U.S. Navy, Washington, D.C.
  - Office of Chief of Navy Operations, Washington, D.C.
  - Naval Oceanography Division, U.S. Naval Observatory, Washington, D.C.
- Office of Economic Opportunity, Washington, D.C.
- Energy, Department of, Washington, D.C.
  - Bonneville Power Administration, Portland, Oregon
- Environmental Protection Agency, Washington, D.C.
  - Office of Environmental Review, Washington, D.C.
  - EIS Review Coordinator, Seattle, Washington
- Federal Energy Regulatory Commission, Washington, D.C.
- General Services Administration, Washington, D.C.
- Health and Human Services, Washington, D.C.
- Housing and Urban Development, Washington, D.C.
  - Regional Administrator X, Seattle, Washington
- Interior, Department of, Washington, D.C.
  - Bureau of Land Management, Prineville, Oregon
  - Bureau of Indian Affairs, Portland, Oregon
  - Crater Lake National Park, Crater Lake, Oregon
  - Fish and Wildlife, Portland, Oregon
  - Interstate Commerce Commission, Washington, D.C.
- Labor, Department of, Washington, D.C.
- National Aeronautics and Space Administration, Washington, D.C.
- National Endowment for the Arts, Washington, D.C.
- New England River Basins Commission, Boston, Massachusetts
- Ohio River Basins Commission, Lexington, Kentucky
- Tennessee Valley Authority, Knoxville, Tennessee
- Transportation, Department of, Washington, D.C.
  - Coast Guard, Washington D.C., and Seattle, Washington
  - Federal Aviation Administration, NW Region, Seattle, Washington

Federal Highway Administration, Portland, Oregon
Federal Railroad Administration, Washington, D.C.

Federal Congressional Delegation
U.S. Representatives
Honorable Les AuCoin
Honorable Denny Smith
Honorable Bob Smith
Honorable Jim Weaver
Honorable Ron Wyden
U.S. Senators
Honorable Mark O. Hatfield
Honorable Bob Packwood

STATE

Oregon

Governor, State of Oregon

Legislative Assembly
Honorable Bill Bellamy, State Representative
Honorable Peter Brockman, State Senator
Honorable Ken Jernstedt, State Senator
Honorable Thomas Throop, State Representative, Bend, Oregon

Agencies
Archaeological Preservation Commission, West Linn
Department of Economic Development, Bend
Department of Energy, Salem
Department of Environmental Quality, Bend
Department of Environmental Quality, Portland
Department of Fish and Wildlife, Bend
Department of Forestry, Salem
Department of Forestry, Sisters
Department of Forestry, Prineville
Department of Environmental Quality, Portland
Land Conservation and Development Commission, Salem
Department of Geology and Minerals Industry, Portland
Oregon Environmental Council, Portland
State Clearinghouse, Intergovernmental Relations Division

County and City Governments
Bend Metro Parks and Recreation District, Bend
City of Eugene, Eugene
Confederated Tribes of the Warm Springs Reservation, Warm Springs
Deschutes County Board of Commissioners
Jefferson County Commission, Madras
Jefferson County Planning, Madras
Klamath County Commissioners, Klamath Falls
Lake County Commission, Lakeview
Redmond Chamber of Commerce, Redmond
Sisters Planning Commission, Sisters
Bend City Commissioners, Bend
C.O. Intergovernmental Council, Redmond
City of Redmond, Redmond
City Planner, Bend

Deschutes County Planning, Bend
Deschutes County Commissioners, Bend

Washington
Department of Natural Resources, Olympia
State Department of Ecology, NEPA Coordinator

Idaho
Division of Environment, Coeur D'Alene, Idaho

BUSINESS GROUPS
AMAX Exploration, Inc., Golden, Colorado
American Plywood Association, Tacoma, Washington
Ames Associates, Inc., Lake Oswego, Oregon
Aminoil USA Inc., Santa Rosa, California
Aminoil USA Inc., Huntington Beach, California
AMOCO Products Company, Denver, Colorado
AMOCO Production Company, Denver, Colorado
Anadarko Products Company, Houston, Texas
ARCO Exploration Company, Denver, Colorado
Association of Oregon Loggers, Inc., Springfield, Oregon
Atlantic Richfield, Bakersfield, California
Atlantic Richfield Co., Dallas, Texas
Black Butte Ranch, Homeowners Association, Sisters, Oregon
Boise Cascade Corporation, Boise, Idaho
Brooks Resources, Bend, Oregon
California Energy Co., Santa Rosa, California
Cascadia Exploration Corporation, Escondido, California
Chevron Resources, San Francisco, California
Chevron Resources Co., San Francisco, California
Chevron U.S.A. Inc., Concord, California
Cities Service Co., Bakersfield, California
Cities Service Oil Company, Houston, Texas
Conoco Inc., Houston, Texas
Crescent Lake Association, Pleasant Hill, Oregon
Crossroads Property Owners Association, Salem, Oregon
Delta Funds, Inc., Philadelphia, Pennsylvania
Deschutes Economic Development Commission, Redmond, Oregon
Diamond International, Bend, Oregon
Exxon Company USA, Los Angeles, California
Exxon Company USA, Denver, Colorado
Francana Resources, Inc., Calgary, Canada
General American Oil Company of Texas, Dallas, Texas
Geothermal Resources Council, Davis, California
Getty Oil Company, Bakersfield, California
Gilchrist Timber Company, Gilchrist, Oregon
GRI International Inc., Menlo Park, California
Gulf Mineral Resources, Denver, Colorado
Gulf Oil Exploration, Bakersfield, California
Harold Barclay Logging, Inc., Sisters, Oregon
Hawthorne Oil Company, Casper, Wyoming
Industrial Forestry Association, Portland, Oregon
INTASA, Menlo Park, California
International Snowmobile Ind. Assn., Washington, D.C.
Louisiana-Pacific Corporation, Prineville, Oregon
Magma Power Company, Los Angeles, California
Mapco Geothermal, Tulsa, Oklahoma

Marathan Oil Company, Anchorage, Alaska
Mason, Bruce, and Girard, Inc., Portland, Oregon
MCO Resources, Inc., Los Angeles, California
Metolius Summer Homeowners Association, Arch Cape, Oregon
Milius and Edgar Log Scaling Service, Bend, Oregon
Mixt Bag, Portland, Oregon
Mobil Oil Corporation, Denver, Colorado
MONO Power, Rosemead, California
Monsanto Company, Tualatin, Oregon
Mt. Bachelor, Inc., Bend, Oregon
National Forest Products Association, Washington, D.C.
Northwest Mining Association, Spokane, Washington
Northwest Pine Association, Spokane, Washington
Northwest Timber Association, Eugene, Oregon
Occidental Geothermal, Inc., Bakersfield, California
Occidental Petroleum, Bakersfield, California
Ochoco Lumber Company, Prineville, Oregon
Oregon Hunter's Association, Bend, Oregon
Pacific Gas Transmission, Spokane, Washington
Pacific Gas Transmission Company, San Francisco, California
Pacific Northwest Ski Association, Seattle, Washington
Pacific Research Management, Inc., Los Angeles, California
Phillips Petroleum Company, Salt Lake City, Utah
Phillips Petroleum Company, Bartlesville, Oklahoma
Phillips Petroleum Company, Englewood, Colorado
PNW River Basins Commission, Vancouver, Washington
Portland General Electric, Portland, Oregon
R.C. Dick Geothermal Corporation, San Rafael, California
Republic Geothermal, Santa Fe Springs, California
Republic Geothermal Inc., Santa Fe Springs, California
SAI Engineers, Inc., Santa Clara, California
SEA-TAC Geothermal, Portland, Oregon
Shell Oil Company, Ventura, California
Southland Royalty Company, Fort Worth, Texas
Southwest Forest Industries, Phoenix, Arizona
SUNDECO, Dallas, Texas
Sunmark Exploration Company, Ventura, California
Tenneco Oil Company, Bakersfield, California
Texaco Incorporated, Englewood, Colorado
Texaco Incorporated, Los Angeles, California
Thermal Power Company, San Francisco, California
Tumalo Irrigation District, Bend, Oregon
Union Oil Company, Los Angeles, California
Union Oil Company of California, Los Angeles, California
Union Oil Company of California, Santa Rosa, California
Western Forestry and Conser. Assn, Portland, Oregon
Western Environmental Trade Association, Portland, Oregon
Western Forest Industries, Association, Portland, Oregon
Western Land Development, Lake Oswego, Oregon
Western Oil and Gas Association, Los Angeles, California
Western Wood Products Association, Portland, Oregon
Weyerhaeuser Company, Klamath Falls, Oregon
Weyerhaeuser Corporation, Tacoma, Washington
Willamette Industries-Korpine, Bend, Oregon
George R. Priest, Portland, Oregon

List of Agencies, Organizations and Persons

INTEREST GROUPS

Archaeological Associates Northwest Inc., Portland, Oregon
Bend Chamber of Commerce, Bend, Oregon
Cascade Holistic Economic Consul., Eugene, Oregon
Central Cascade Conservation, Salem, Oregon
Central Oregon Audubon Chapter, Bend, Oregon
Chemeketans, Salem, Oregon
COPE, Bend, Oregon
Defenders of Wildlife, Medford, Oregon
Earth Power Corporation, Tulsa, Oklahoma
ECO - Northwest, Limited, Eugene, Oregon
Federation of Western Outdoor Clubs, Seattle, Washington
Friends of the Earth, Seattle, Washington
Friends of the Earth, San Francisco, California
Friends of the Three Sisters Wilderness, Inc., Eugene, Oregon
Klah Klahnee Wildlife Sanctuary, Sisters, Oregon
Lane County Audubon Society, Eugene, Oregon
League of Women Voters, Sunriver, Oregon
Lively Livestock 4-H Club, LaGrande, Oregon
Mazamas, Portland, Oregon
Moon Country Snowmobilers Inc., Bend, Oregon
National Wildlife Federation, Washington, D.C.
National Wildlife Federation, Portland, Oregon
Natural Resource Defense Council, San Francisco, California
Nature Conservency, Portland, Oregon
Odell Lake Summer Home Association, Eugene, Oregon
Old Cascades Wilderness Commission, Corvallis, Oregon
Oregon Archaeological Preservation Commission, West Linn, Oregon
Oregon Environmental Council, Portland, Oregon
Oregon Equestrial Trails, Tigard, Oregon
Oregon High Desert Museum, Bend, Oregon
Oregon Motorcycle Riders Asociation, Oregon City, Oregon
Oregon Summer Home Association, Salem, Oregon
Oregon Wilderness Coalition, Portland, Oregon
Oregon Wilderness Coalition, Eugene, Oregon
Oregon Forest Protection Association, Portland, Oregon
Oregon Natural Heritage, Portland, Oregon
Oregon Natural Resources Council, Eugene, Oregon
Pacific Northwest Ski Association, Seattle, Washington
Proctor, Puckett and Fairclo, Klamath Falls, Oregon
Sierra Club, San Francisco, California
Sierra Club, Eugene, Oregon
Sierra Club Legal Defense Fund, San Francisco, California
Sierra Club of Oregon, Salem, Oregon
Sierra Club-Juniper Group, Bend, Oregon
Sierra Club, Many Rivers Group, Eugene, Oregon
Sierra Club, Northwest Office, Seattle, Washington
Sunriver Owners Association, Sunriver, Oregon
Sunriver Properties, Inc., Sunriver, Oregon
Tahoma Audubon Society, Tacoma, Washington
The Mountaineers, Seattle, Washington
The Wildlife Society, Corvallis, Oregon
Washington State Horsemen, Alderwood Manor, Washington
Wilderness Society, Seattle, Washington
Wilderness Society, Washington, D.C.
Wildlife Management Institute, Portland, Oregon

Willdan Association, Tigard, Oregon
1000 Friends of Oregon, Portland, Oregon

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Bureau DeRecherrches, 45060 Orleans Cedex, France

NEWS MEDIA

The Bulletin, Bend, Oregon
Eugene Register-Guard, Eugene, Oregon
Oregonian, Portland, Oregon
Oregonian Correspondent, LaPine, Oregon

SCHOOLS AND LIBRARIES

Agricultural Research Service, Pullman, Washington
Association for Oregon Archaeology, Eugene, Oregon
Central Oregon Community College Forestry Department, Bend, Oregon
Central Oregon Community College Library, Bend, Oregon
Denver Public Library, Denver, Colorado
Deschutes County Library, Bend, Oregon
Dean, Col. of Science, Corvallis, Oregon
Forestry and Outdoor Recreation, Logan, Utah
Lake County Library, Lakeview, Oregon
Land, Air, Water, Eugene, Oregon
Lewis and Clark College, Portland, Oregon
Oregon Student, Portland, Oregon
Oregon State University School of Forestry, Corvallis, Oregon
Portland State University, Portland, Oregon
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University of Oregon Survival Center, Eugene, Oregon
University of Florida, Gainesville, Florida
University of Washington, Seattle, Washington
Utah State University, Logan, Utah
Washington State University, Pullman, Washington
Whitman College, Walla Walla, Washington

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L. H. Armour, Chicago, Illinois
Dennis Baird, Moscow, Idaho
Sherman M. Becker, New York, New York
Robert A. Bernhard, New York, New York
Jim Boyle, Corvallis, Oregon
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Rob Burnett, Portland, Oregon
Heather Cook, Toronto, Ontario, Canada
Michael Christie, Coeur d'Alene, Idaho
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Marti Gerdes, Bend, Oregon
Daniel L. Goldy, Portland, Oregon
Sarah Greene, Corvallis, Oregon
Mr. B. L. Harris, LaGrande, Oregon
Lawrence C. Hart, Red Bluff, California
Joan Hett, PhD, Seattle, Washington
Fred Hirsh, Monmouth, Oregon
John W. Hook, Salem, Oregon
Fred Hornback, Bend, Oregon
S. Kyle Huber, Portland, Oregon
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Toni Johnson, Camp Sherman, Oregon
Bill Keil, Portland, Oregon
Edward Kelley, Salem, Oregon
Chris Kittell, Pacific City, Oregon
Terry A. Kramer, New York, New York
A. E. Levy, San Francisco, California
Leeanne G. MacColl, Portland, Oregon
Bob Main, Bend, Oregon
R. W. Markley, Jr., Washington, D.C.
Mr. & Mrs. George W. Moffit, Jr., Bryn Mawr, Pennsylvania
C. F. Murer, Denver, Colorado
Larry Nall, Bend, Oregon
Carl A. Newport, Portland, Oregon
Earl E. Nichols, Bend, Oregon
V. M. O'Net, Jr., New York, New York
Randall O' Toole, Eugene, Oregon
H.H.S. Phillips, Hartwell, Georgia
Bob Pickard, Bend, Oregon
George R. Priest, Portland, Oregon
Starr W. Reed, Bellevue, Washington
Jerry L. Roberts, Mill Valley, California
Bob Robinson, Bend, Oregon
Joe Ross, Portland, Oregon
John S. Runnells, Chicaco, Illinois
Mr. Fred Sawyer, Portland, Oregon
Paul F. Scheibe, Ranco Santa Fe, California
Joseph C. Schott, Grand Forks AFD, North Dakota
Rocks L. Senger, Seattle, Washington
Ronald L. Simon, Longview, Washington
H. Somers, Portland, Oregon
Jim Spitz, Bend, Oregon
Edward B. Towne, Jr., Sacramento, California
Don Tryon, Prineville, Oregon
Dick VanDerschaff, Portland, Oregon

Richard Toll Ward, Sisters, Oregon
George W. Waters, Fairhaven, New Jersey
Gary Weston, Camp Sherman, Oregon
Floyd W. Wisely, Enterprise, Oregon

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2300-2A (CPO) 12/1/79 Summary - Sites and Areas Descriptive Data
2300-2G (CPO) Summary - Composite Info.
2300-6 Facility - Condition Record
2300-6A O&M Costs Analysis
2300-6B Summary, Dollar Needs
2300-6E (CPO) - Summary O&M Dollar Requirements
2300-6G (CPO) - Aid for Dollar Allocation Various Other
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GLOSSARY

Acre Equivalent - A conversion factor applied to the actual acres of wildlife habitat improvement to show that a larger area of habitat was improved rather than just the treated acres.

Acre Foot (Ac. Ft.) - A unit for measuring a volume of water. Quantity of water required to cover 1 acre to a depth of 1 foot.

Activity - A measure, course of action, or treatment that is undertaken to directly or indirectly produce, enhance, or maintain forest and rangeland outputs or achieve administrative or environmental quality objectives. FSH 1309.11, The Management Information Handbook sets forth Forest Service activity definitions, codes, and units of measure.

Allocatable Unit - Areas of land which for social, managerial, and/or political reasons should be allocated as a whole or not at all to a particular management area.

Allowable Sale Quantity - The quantity of timber that may be sold from the area of suitable land covered by the forest plan for a time period specified by the plan. This quantity is usually expressed on an annual basis as the "average annual allowable sale quantity." (36 CFR 219.3)

Alternative - One of several policies, plans, or projects proposed for decisionmaking.

Amenity - An object, feature, quality, or experience that gives pleasure or is pleasing to the mind or senses. Amenity value is typically used in land-use planning to describe those resource properties for which market values (or proxy values) are not or cannot be established.

Analysis Area - A delineated area or land subject to analysis of (1) responses to proposed management practices in the production, enhancement, or maintenance of forest and rangeland outputs and environmental quality objectives, and (2) economic and social impacts.

Analysis of the Management Situation - A step required under the National Forest Management Act in which the Forest determines its ability to supply goods and services to meet society's demand for them.

Animal Unit (AU) - An animal unit is a 1,000 pound mature cow, or its equivalent based on an average daily forage consumption of 26 pounds dry matter per day.

Animal Unit Month (AUM) - The forage requirement for one month (26 pounds x 30.5 days =800 pounds).

Livestock Class	AUM Factors
Mature Cow	1.00
Mature Cow w/Nursing Calf	1.32
Yearling (9-18 months)	0.70
Bull	1.50
Mature Sheep	0.20
Ewe w/lamb	0.30
Horse	1.20

Basal Area - The cross-sectional area of a tree, usually measured at breast height (4-½ feet above the ground). Basal area can be determined for one tree or for all the trees on an acre. The basal area per acre is a measure of the density of tree growth on that acre. Basal area is measured in square feet.

Base Sale Schedule - A timber sale schedule formulated on the basis that the quantity of timber planned for sale and harvest for any future decade is equal to or greater than the planned sale and harvest for the preceding decade, and this planned sale and harvest for any decade is not greater than the long-term sustained yield capacity. (36 CFR 219.3)

Benchmark - The process where by a Forest determines it capability to supply outputs both with and without legal requirememts. A determination of the maximum capability within which Alternatives are developed.

Biological Potential - The maximum amount of sustainable wood fiber obtainable by application of intensive management practices to acres classified as commercial forest land.

Board Foot - A volume of solid wood, 1 foot square and 1 inch thick.

Capability - The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as on the application of management practices, such as silviculture or protection from fire, insects, and disease.

Capability Area - An area of land which has homogeneous ability to produce various outputs.

CEQ - Council on Environmental Quality.

Chargeable Timber Volume - All volume included in the growth and yield projections for the selected management precriptions used to arrive at the allowable sale quantity, based on regional utilization standards.

Consistent with the definition of timber production, planned production of fuelwood is not included in the allowable sale quantity and therefore is nonchargeable.

Chip Type or Chippable - Refers to a stand of lodgepole pine in which most live stems are under 8.0 inches diameter at breast height or are merchantable dead and sometimes chipped for use as pulpwood.

CCC - Civilian Conservation Corps

Clearcut - A cut which removes all trees from a designated area at one time.

CMAI - Culmination at mean annual increment.

Commercial Forest Land - Forest land that is producing or is capable of producing crops of industrial wood and (a) has not been withdrawn by Congress, the Secretary, or the Chief; (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity, or watershed conditions; and (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that adequate restocking can be attained within 5 years after final harvesting.

Commercial Thinning - A cut in a stand under rotation age designed to remove excess merchantable trees. The objective is to place the growth capability of the site on the remaining leave trees.

Commodities - Tangible and intangible products (i.e., outputs of wood, water, wildlife, visuals, etc.) that can be turned to commercial or other advantage.

Common Minerals - Materials such as sand, stone, gravel, pumice (except block pumice), pumicite, or cinders.

Concern - A point, matter, or question raised by management that must be addressed in the planning process.

Confined Fire - To restrict the fire within determined boundaries established either prior to the fire, during the fire, or in an escaped fire situation analysis.

Contained Fire - To surround a fire, and any spot fires therefrom, with control line, as needed, which can reasonably be expected to check the fire's spread under prevailing and predicted conditions.

Controlled Fire - To complete the control line around a fire, any spot fires therefrom, and any interior islands to be saved; burn out any unburned area adjacent to the fire side of the control line; and cool down all hot spots that are immediate threats to the control line, until the line can reasonably be expected to hold under foreseeable conditions.

Conversion Period - A transition period during which an unregulated forest structure is converted to a regulated one. When regulated, the forest will have a distribution of stand age and size classes, providing approximately equal periodic harvests.

Corridor - A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries.

Cost Effective - Achieving specified outputs or objectives under given conditions for the least cost.

Cost Efficiency - The usefulness of specified inputs (costs) to produce specified outputs (benefits). In measuring cost efficiency, some outputs including environmental, economic, or social impacts, are not assigned monetary values but are achieved at specified levels in the least cost manner. Cost efficiency is usually measured using present net value, although use of benefit-cost ratios and rates-of-return may be appropriate. (36 CFR 219.3)

Cover/Forage Ratio - The ratio, in percent, of the amount of area in forage condition to that area in cover condition; the criteria by which potential deer and elk use of an area is judged.

Cover - Vegetation used by wildlife for protection from predators, or to ameliorate conditions of weather, or in which to reproduce.

Created Opening - Created openings are openings in the forest created by the silvicultural practices of shelterwood regeneration cutting at the final harvest, clearcutting, seed tree cutting, or group selection cutting.

Culmination of Mean Annual Increment - The age at which the average annual growth is greatest for a stand of trees. Mean annual increment is expressed in cubic feet measure and is based on expected growth according to the management intensities and utilization standards assumed in accordance with 36 CFR 219.16(a)(2)(i) and (ii). Culmination of mean annual increment (CMAI) includes regeneration harvest yields and any additional yields from planned intermediate harvests.

Cultural Resources - The remains of sites, structures, or objects used by humans in the past; historical or archaeological.

Current Direction - As used in this DEIS it is continuing on with the 1978 Land Management Plan for the Deschutes National Forest and the 1974 Timber Management Plan as revised in 1980 and 1984.

d.b.h. - Diameter at breast height. The diameter of a tree measured 4 feet 6 inches from the ground.

d.i.b. - Diameter inside bark.

DEIS - Draft Environmental Impact Statement.

Demand - The amount of an output that users are willing to take at a specified price, time period, and condition of sale.

Departure - A schedule which deviates from the principle of nondeclining flow by exhibiting a planned decrease in the timber sale and harvest schedule at any time in the future.

Developed Recreation - Recreation use that occurs within a site or facility specifically established and constructed for public recreation purposes. Activities commonly included are camping, picnicking, resort use, and downhill skiing, but can also include parking areas, trailheads, boat launching sites, etc.

Discounting - An adjustment, using a discount rate for the values of money over time so that costs and benefits occurring in the future are reduced to a common point in time, usually the present, for comparison.

Dispersed Recreation - Recreation use outside of a developed recreation site, ranging from scenic driving to backpacking.

Diversity - The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan. (36 CFR 219.3)

Ecoclass - A grouping of one or more naturally occurring plant community types.

Ecosystem - The interacting system of a biological community and its nonliving environment.

Effects - Environmental consequences as a result of a proposed action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time or further removed in distance, but which are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Effects and impacts as used in this DEIS are synonymous. Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic quality, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effects will be beneficial (40 CFR 1508.8).

Effective, Physical, Biological - The change, positive or negative, in the physical or biological conditions which directly or indirectly results from an activity, project, or program.

Effect, Economic - The change, positive or negative, in economic conditions, including the distribution and stability of employment and income in affected local, regional, and national economies, which directly or indirectly result from an activity, project, or program.

Effect, Social - The change, positive or negative, in social and cultural conditions which directly or indirectly result from an activity, project, or program.

Empirical Yield Table - A table reflecting the existing standing timber volumes today and how they would grow in the future, under various timber managment regimes.

Endangered Species - Any species listed in the Federal Register, which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of the Act would present an overwhelming and overriding risk to man.

Environment - The sum of all external conditions and influence affecting the life, development, and survival of an organism.

Escaped Fire - A fire which has exceeded, or is anticipated to exceed, initial action capabilities or the key fire management direction or prescription.

Escaped Fire Situation Analysis - A decision analysis of those factors influencing suppression of an escaped fire from which a plan of action will be developed. The analysis includes the development of alternative suppression strategies and net effect of each.

Even-Aged Management - The application of a combination of actions that results in the creation of stands in which trees of essentially the same age grow together. Managed even-aged forests are characterized by a distribution of stands of varying ages (and, therefore, tree sizes throughout the forest area). The difference in age between trees forming the main canopy level of a stand usually does not exceed 20 percent of the age of the stand at harvest rotation age. Regeneration in a particular stand is obtained during a short period at or near the time that a stand has reached the desired age or size for regeneration and is harvested. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

Even Flow - Maintaining a relatively constant supply of timber from year to year.

Experimental Forest - A small protion of the Deschutes National Forest known as the Pringle Falls Experimental Forest which is used as a field laboratory for research.

Extensive Timber Management - A relatively low level of capital is invested in timber practices intended to increase wood fiber production.

Final Overstory Removal - Removal of all of a mature overstory from a manageable immature understory timber stand.

Fire Intensity - The severity of a given fire. Low intensity fires average flame lengths under 4 feet and high intensity fires average flame lengths over 4 feet.

Fire Management Effectiveness Index (FMEI) -

$$\frac{\text{(FMEI)} = \text{(Fire Prog} + \text{FFF \$-Fuels Capital Invest. \$} + \text{NVC \$)} \times \text{A}}{\text{M Acres Protected} \times \text{SI} \times \text{B}}$$

When:
A = Consumer Price Index (1979 $ = 1.0)
B = A potential inter-unit workload value now established at 1.0.
SI = Severity Index fixed at 1.0 for planning purposes.
NVC = Net Value Change, expressed as a cost, usually a positive number.
Fire Prog = Fire program, presuppression dollars.
FFF = Fighting forest fire dollars.

Floodplains - The lowland and relatively flat areas adjoining inland and coastal waters, including, at a minimum, that area subject to a one percent or greater chance of flooding in any given year.

Forage - All browse and nonwoody plants available to livestock or wildlife for grazing or harvested for feed.

Forest Influence Area (FIA) - The area surrounding a National Forest that is strongly affected by activities occurring within the Forest.

FORPLAN - The forest planning model. A linear programming software package used to analyze planning decisions regarding land use patterns, capital investment, and timber harvest scheduling.

Fuel Break - A strategically located strip or block of land on which the native vegetation has been modified by appropriate fuel treatment methods to a lighter or less dense fuel type. Fuel breaks break up the continuity of heavy, hazardous fuels so that fires burning to them can be readily controlled.

Fuel Hazard - A supply of vegetative fuel that forms a special threat of ignition or suppression difficulty.

Fuel Treatments - Levels and methods of fuels treatment will be guided by the resource objectives within the Management Area.

Geothermal Energy - Internal heat from the earth.

Habitat - The sum total of environmental conditions of a specific place occupied by a wildlife or plant species or a population of such species.

Harvest Cutting Method - A combination of interrelated actions whereby forests are tended, harvested, and replaced. The combination of management practices used to manipulate the vegetation results in forests of distinctive form and character. Harvest cutting methods are classified as even-aged and uneven-aged.

Hydrologic - Pertaining to the quantity, quality, and timing of water yield from forested lands.

Input/Output Analysis - A technique for analyzing the interdependence of producing and consuming sectors in an economy.

Integrated Pest Management - A process for selecting strategies to regulate forest pests in which all aspects of a pest-host system are studied and weighed. The information considered in selecting appropriate strategies includes the impact of the unregulated pest population on various resources values, alternative regulatory tactics and strategies, and benefit/cost estimates for these alternative strategies. Regulatory strategies are based on sound silvicultural practices and ecology of the pesthost system and consist of a combination of tactics such as timber stand improvement plus selective use of pesticides. A basic principle in the choice of strategy is that it be ecologically compatible or acceptable. (36 CFR 219.3)

Intensive Timber Management - A relatively high level of capital investment in timber management practices intended to increase wood fiber production.

Interdisciplinary - The integrated use of natural and social sciences and the environmental design arts in planning and decisionmaking.

Intensive Forest Management - A high investment level of timber management that envisions initial harvest, regeneration, with genetically improved stock, control of competing vegetation, fill-in planting, precommercial thinning as needed for stocking control, one or more commercial thinnings, and final harvest.

Intermingled Ownerships - Lands within the National Forest boundaries or surrounded by National Forest lands that are owned by private interests or other government agencies. Because of early land grants, these lands frequently are in checkerboard ownership patterns.

Irretrievable - Applies to losses of production, harvest, or use of renewable natural resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a winter sports site. If the use is changed, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

Irreversible - Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity, that are renewable only over long periods. Irreversible also includes loss of future options.

Known Geothermal Resource Area - An area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary of Interior, engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose. Under these conditions the leasing would be on a competitive bid basis.

Land Allocation - The decision to use land for various resource management objectives in order to best satisfy the planning process issues, concerns, and opportunities, and meet assigned forest output targets.

Land Capability - A measure of the capability of the land to produce goods and services without imposed restraints, such as lack of manpower and finances or other priority uses and without damage to the land.

Land Suitability - A measure of the suitability of land, as it exists in natural condition, for a single resource use or combination of uses.

Landtype - Units of land with similar vegetative soil, and landform characteristics and capabilities, which respond similarly to management activities.

Leasable Minerals - Generally include minerals such as oil, gas, oil shale, coal, potassium, sodium, phosphates, sulphur, and geothermal. The Deschutes National Forest appears to have potential only for geothermal and possibly oil and gas.

Locatable Minerals - These resources include gold, silver, lead, copper, and mercury, which are mined and processed for metals, and some uncommon nonmetallics.

Long-Term Sustained-Yield Timber Capacity - The highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple-use objectives.

M - The Roman numeral for 1000.

Maximum Modification - A visual quality objective meaning human activities may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.

MBF - Thousand board feet (MMBF - million board feet).

Megawatt - One thousand kilowatts.

MMCF - One million cubic feet. New timber management plans express tree or log volume on a cubic foot basis because it is a truer representation of actual volume of wood fiber than is board foot volume. A cubic foot is a volume of wood equivalent to a cube 12 inches on all sides.

Managed Stand - A stand of trees in which stocking level control is applied to achieve maxium growth.

Managed Yield Table - A table showing, for a given species on a given site, the progressive development of a managed stand at periodic intervals covering the greater part of its useful life. It usually includes average diameter, basal area, number of trees, standing volume, and harvest volumes for a specific timber management regime.

Management Areas - A unit of land allocated to emphasize a particular resource, based on the capability of the area.

Management Concern - An issue, problem or a condition which constrains the range of management practices identified by the Forest Service in the planning process.

Management Direction - A statement of multiple-use and other goals and objectives, the associated management prescriptions, and standards and guidelines for attaining them.

Management Intensity - A management practice or combination of management practices and associated costs designed to obtain different levels of goods and services.

Management Practice - A specific activity, measure, course of action, or treatment.

Management Prescription - Management practices selected and scheduled for application on a specific area to attain multiple-use and other goals and objectives.

Market Resources - Products derived from renewable and nonrenewable resources that have a well-established market value, for example, forage, timber, water, and minerals.

Minimum Viable Population - The low end of the viable population range.

Mitigation - To moderate the force or intensity of environmental effects.

Mixed Conifer - A stand of coniferous trees in which no single species makes up more that 50% of the composition of the stand.

Modification - A visual quality objective meaning human activities may dominate the characteristic landscape but must also utilize naturally established formline, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

Monitoring (Program) - Close evaluation of the implementation of Forest activities for conformance with the standards and guidelines and objectives as stated in the Forest Plan.

Mountain Pine Beetle - A small insect that bores into trees introducing a fungus which can kill the tree if the tree does not successfully repel the attack.

Mortality - The volume of sound wood dying from natural causes during a specified period.

Multiple Use - The management of all the various renewable surface resources of the National Forest System so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

Municipal Watershed - A watershed that serves a public water system as defined in the Safe Drinking Water Act and associated regulations.

NEPA - National Environmental Policy Act of 1969. A law directing Federal agencies to evaluate environmental effects of proposed action.

Net Public Benefits - An expression used to signify the overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index. The maximization of net public benefits to be derived from management of units of the National Forest System is consistent with the principles of multiple-use and sustained-yield.

NFMA - The National Forest Management Act of 1976.

Nonchargeable Volume - All volume not included in the growth and yield projections for the selected management prescriptions used to arrive at the allowable sale quantity.

Noncommercial Forest Land - Unproductive forest land incapable of yielding 20 cubic feet of wood per acre per year because of adverse site conditions and productive forest land withdrawn from commercial timber use through statute or administrative regulation.

Noncommercial Species - Species that have no economic values at this time nor anticipated timber value within the near future.

Nondeclining Flow - See Base Sale Schedule.

Nonforest Land - Lands that never have had or that are incapable of having 10 percent or more of the area occupied by forest trees; or lands previously having such cover and currently developed for nonforest use.

Nonmarket - Products derived from National Forest resources that do not have a well-established market value, for example, wilderness, wildlife.

Nonpriced Outputs - Outputs for which there is no available market transaction evidence and no reasonable basis for estimating a dollar value comensurate with the market values associated with the priced outputs.

Off-Road Vehicle (ORV) - A motorcycle, dune buggy, four-wheel drive, snowmobiles, or other vehicle that is designed to operate off of a road.

Old Growth - Overmature trees well past their optimum growth period and past age of rotation.

Opening - An area without trees.

Output - The goods, end products, or services that are purchased, consumed, or used directly by people. Goods, services, products, and concerns produced by activities that are measurable and capable of being used to determine the effectiveness of programs and activities in meeting objectives. A broad term for describing any result, product, or service that a process or activity actually produces.

Overwood Removal - A type of harvest which is designed to remove part or all of the over-aged trees in the overstory. The objective is to release the acceptably stocked understory.

Persons-at-one-Time (PAOT) - In recreation, PAOT means persons at one time. It is a measure of recreation capacity in the number of people that can occupy a site or area and achieve a desired recreation experience. It can be used as a design standard and an indicator of productive capacity for a site or area.

Partial Overstory Removal (POR) - Removal of a portion of the overstory from a manageable understory, where an intolerable amount of damage would be done to the understory if all the overstory were removed at one time. The intention in a partial overstory removal cut is to remove the remainder of the overstory a short time later.

Partial Retention - A visual quality objective which means human activities may be evident, but must remain subordinate to the characteristic landscape.

Planned Ignitions - A fire started by a deliberate management action.

Planning Horizon - The overall time period considered in the planning process that spans all activities covered in the analysis or plan and all future conditions and effects of proposed actions which would influence the planning decisions. (36 CFR 219.3)

Planning Period - One decade. The time interval within the planning horizon that is used to show incremental changes in yields, costs, effects, and benefits. (36 CFR 219.3)

Plant Communities - A homogeneous unit in respect to the number and relationship of plants in the tree, shrub, and ground cover strata.

Precommercial Thinning - The practice of removing some of the trees less than merchantable size from a stand so that the remaining trees will grow faster.

Prescribed Burning - Use of fire in forest management for hazard reduction and vegetative manipulation.

Prescribed Fire - A wildland fire burning under specified conditions which will accomplish certain planned objectives. The fire may result from either planned or unplanned ignitions. Plans for use of unplanned ignitions for this purpose must be approved by the Regional Forester.

Present Net Value - The difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area. (36 CFR 219.3)

Productivity Classes - Refer to productivity of the land itself. It is a measure of fertility and moisture availability. In technical literature, productivity is classified using a "Site Index" or "Site Class."

Public Issue - A subject or question of widespread public interest relating to management of National Forest System.

Public Participation - Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about Forest Service planning.

Purchaser Credit - Credit earned by the purchaser of a National Forest timber sale by construction of contract-specified roads. Earned purchaser credit may be used by the purchaser as payment for National Forest timber removed.

Real Dollar Value - A monetary value which compensates for the effects of inflation.

Recreation Capacity - The amount of people at one time that can occupy a site or area without causing environmental damage or imparing the desired recreation experience to be provided in that site or area.

Recreation Information Management (RIM) - A computer oriented system for the organization and management of information concerning recreation use, occupancy, and management of National Forest lansd.

Recreation Opportunity Spectrum (ROS) - This refers to a system used to identify and analyze broad categories of recreation opportunity on Forest lands. It involves a Forestwide recreation analysis of the physical setting (remoteness size and evidence of humans), social setting (user density and character), and managerial setting (managerial regimentation and noticeability) on the Forest. It is designed to provide an indication of the kind of experience the recreationist is likely to find in an area.

Recreation Visitor Day (RVD) - A measure of recreational use of a site area. One recreation visitor day consists of 12 hours of recreation use of a site or area. Recreation visitor days are used as a recreation production or output capacity measure.

Reforestation - The restocking of an area with trees.

Regeneration - The reforestation of a tree crop by natural or artificial means.

Regeneration Cut - A cut in a particular stand of timber designed to remove the existing volume and start a new crop. To qualify for regeneration cutting, a stand must be (1) at or beyond rotation age, and (2) lack an understory of acceptable stocking worthy of management, or (3) have a disease-infected understory which will not develop into a future crop, or (4) have an understory which it is not currently physically possible to save during felling, skidding, and slash disposal operations.

Regeneration Methods - Silvicultural practices used to remove existing stands of timber and start new stand.

Regulations - Generally refers to the Code of Federal Regulations, Title 36, Chapter II, which cover management of the Forest Service.

Rehabilitation - Actions taken to protect or enhance site productivity, water quality, or other values for a short period of time.

Research Natural Areas (RNA's) - Formally designated tracts of land where natural processes are allowed to continue and where natural features are preserved for education and research.

Resource Production - The production and use of natural resources, such as timber and forage.

Resource Values - The tangible and intangible worth of forest resources.

Restoration - The long-term placement of land back into its natural condition or state of productivity.

Retention - A visual quality objective which means human activities are not evident to the casual forest visitor.

RIM - See Recreation Information Management.

Riparian Areas - Geographically delineated areas, with distinctive resource values and characteristics, that are comprised of the aquatic and riparian ecosystems, floodplains, and wetlands. They include all areas within a horizontal distance of 100 feet from the edge of perennial streams or other water bodies (FSM 2526.11, Amend. 26, 4/80).

ROS - See Recreation Opportunity Spectrum.

Rotation - The number of years required to establish (including the regeneration period) and grow timber crops to a specified condition or maturity for regeneration harvest. Selected management prescriptions in the Forest Plan provide the basis for the rotation age.

RPA - Forest and Rangeland Renewable Resources Planning Act of 1974.

RVD - See Recreation Visitor Day.

Sanitation Salvage - The removal of dead, damaged, or susceptible trees primarily, essentially to prevent the spread of pests or pathogens and promote forest hygiene.

Sawtimber - Trees that will yield logs suitable in size and quality for the production of dimension lumber.

Sensitive Species - Those species which (1) have appeared in the Federal Register as proposals for classification and are under consideration for offical listing as endangered or threatened species, (2) are on an official State list, or (3) are recognized by the Regional Forester to need special management in order to prevent the need for their placement on Federal or State lists.

Shelterwood Cut (SW) - Designated trees are left to provide seed, shelter, and shade for the new crop. The rest of the mature stand is removed. Regeneration of the new stand may be by natural seedfall or by planting. After the new stand is established, a final harvest removed the shelterwood and releases the young trees to develop in the open as an even-aged forest.

Silviculture - The application ecological theory and principles to achieve timber stand management objective.

Site Index - A measure of the relative productive capacity of an area for growing wood. Measurement of site index is based on height of the dominant trees in a stand at a given age.

Skyline Logging - A system of cable logging in which all or part of the weight of the logs is supported during yarding by a suspended cable.

Snag - A nonliving standing tree. The interior of the snag may be sound or rotted.

Socioeconomic - Pertaining to, or signifying the combination or interaction of, social and economic factors.

Soil Resource Inventory (SRI) - An inventory of the soil resource based on landform, vegetative characteristics, soil characteristics, and management potentials.

Special Interest Area - Are lands set aside to preserve and interpret unique geological, biological, and cultural areas for education, scientific, and public enjoyment.

Stand - A community of trees or other vegetation sufficiently uniform in composition, constitution, age, spatial arrangement, or condition to be distinguishable from adjacent communities and so form a silvicultural or management entity.

SHPO - State Historic Preservation Office

Stocking - The degree to which trees occupy the land, measured by basal area and/or number of trees by size and spacing, compared with a stocking standard, such as, the basal area and/or number of trees required for full utilization of the lands' growth potential.

Stocking Level Control - The process of maintaining the desirable number of trees to achieve optimum growth and management. It not only includes thinnings (both precommercial and commercial) but other cultural work such as brush and rodent control as well.

Streamflow - The discharge of water from a watershed that occurs in a natural stream channel.

Streamside Management Units (SMU) - Areas of and adjacent to streams that are managed in such a manner as to protect and enhance the aquatic habitat and water quality.

Suitability - The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.

Suitable Forest Land - Land to be managed for timber production on a regulated basis.

Sustained Yield - The achievement and maintenance in perpetuity of a periodic output of the renewable resources without impairment of the productivity of the land.

Thermal Cover - Cover used by animals to lessen the effects of weather; for elk, a stand of coniferous trees 40 feet or more tall with an average crown closure of 70 percent or more.

Thinning - The practice of removing some of the trees in a stand so that the remaining trees will grow faster due to reduced competition for nutrients, water, and sunlight. Thinning may be done at two different stages:

1. Commercial thinning - Removing trees that have reached sufficient size to be manufactured into a product.

2. Precommercial thinning - Removing trees that are too small to make a merchantable product.

Threatened Species - Any species listed in the Federal Register which is likely to become an endangered species within the foreseeable future throughout all of a significant portion of its range.

Thrifty - Thrifty refers to the condition of a stand of trees or to the condition of a single tree. Generally a thrifty tree is a healthy tree with dark green needles, a fairly full crown, a pointed crown indicating fairly rapid growth, and otherwise in generally healthy appearance. A thrifty stand would be composed of trees, most of which are individually thrifty.

Timber Classification - Forested land is classified under each of the land management alternatives according to how it related to the management of the timber resource. Timber classifications are Nonforest, Forest, Suitable, Unsuitable, and Commercial.

Timber Harvest Schedule - The quantity of timber planned for sale and harvest, by time period, from the area of land covered by the Forest Plan. The first period, usually a decade, of the selected harvest schedule provides the allowable sale quantity. Future periods are shown to establish that sustained yield will be achieved and maintained.

Timber Stand Improvement - Measures such as thinning, pruning, release cutting, prescribed fire, girdling, weeding, or poisoning of unwanted trees aimed at improving growing conditions for the remaining trees.

Tolerance - The ability of a tree to grow satisfactorily in the shade of, and in competition with, other trees.

Understory Vegetation - Grass, small trees, shrubs, and other plants found beneath the overstory (the trees comprising the forest).

Uneven-Aged Management - The application of a combination of actions needed to simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

Unplanned Ignition - A fire started at random by either natural or human causes, or a deliberate incendiary fire.

Utility Corridor - A strip of land dedicated primarily to some form of transportation, communications, or power.

Viable Population - A viable population consists of the number of individuals, adequately distributed throughout their range, necessary to perpetuate their existence in natural, genetically stable, self-sustaining populations.

Viewshed - The total landscape seen or potentially seen from all or a logical part of a travel route, use area, or water body.

Visual Quality Objectives (VQO's) - Categories of acceptable landscape alteration measured in degrees of deviation from the natural-appearing landscape.

1. Preservation - Ecological change only here.

2. Retention - Human activities are not evident to the casual Forest visitor.

3. Partial Retention - Human activity may be evident, but must remain subordinate to the characteristic landscape.

4. Modification - Human activity may dominate the characteristic landscape, but must, at the same time, follow naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

5. Maximum Modification - Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

Visitor Day - See Recreation Visitor Day.

Visual Quality Objectives - A desired level of visual experience based on physical characteristics and sociological values of an area. Refers to degree of modification of the natural landscape by retention, partial retention, modification, and maximum modification categories.

Visual Resource - That part of the forest that is seen by the human eye; the visual landscape.

Wetlands - Areas that are inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

WFUD - Wildlife and Fish User Day - One WUFD consists of 12 hour of recreation that is the result of fish or wildlife.

Wild and Scenic Rivers - Those rivers or sections of rivers designated as such by congressional actions under the 1968 Wild and Scenic Rivers Act, as wild, scenic, or recreational by an act of the Legislature of the State or States through which they flow. Wild and scenic rivers may be classified and administered under one or more of the following categories:

1. Wild River - Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

2. Scenic River - Those rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

3. Recreational River - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Wilderness - An area established by Congress and managed under the direction of the 1964 Wilderness Act.

Wildfire - Any wildland fire that requires a suppression response.

Working Group - Comprises those parts of a forest that have generally the same silvicultural management and rotation.

Yarding - The moving of logs from the stump where cut to a central concentration area or landing.

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